

Fig. 1

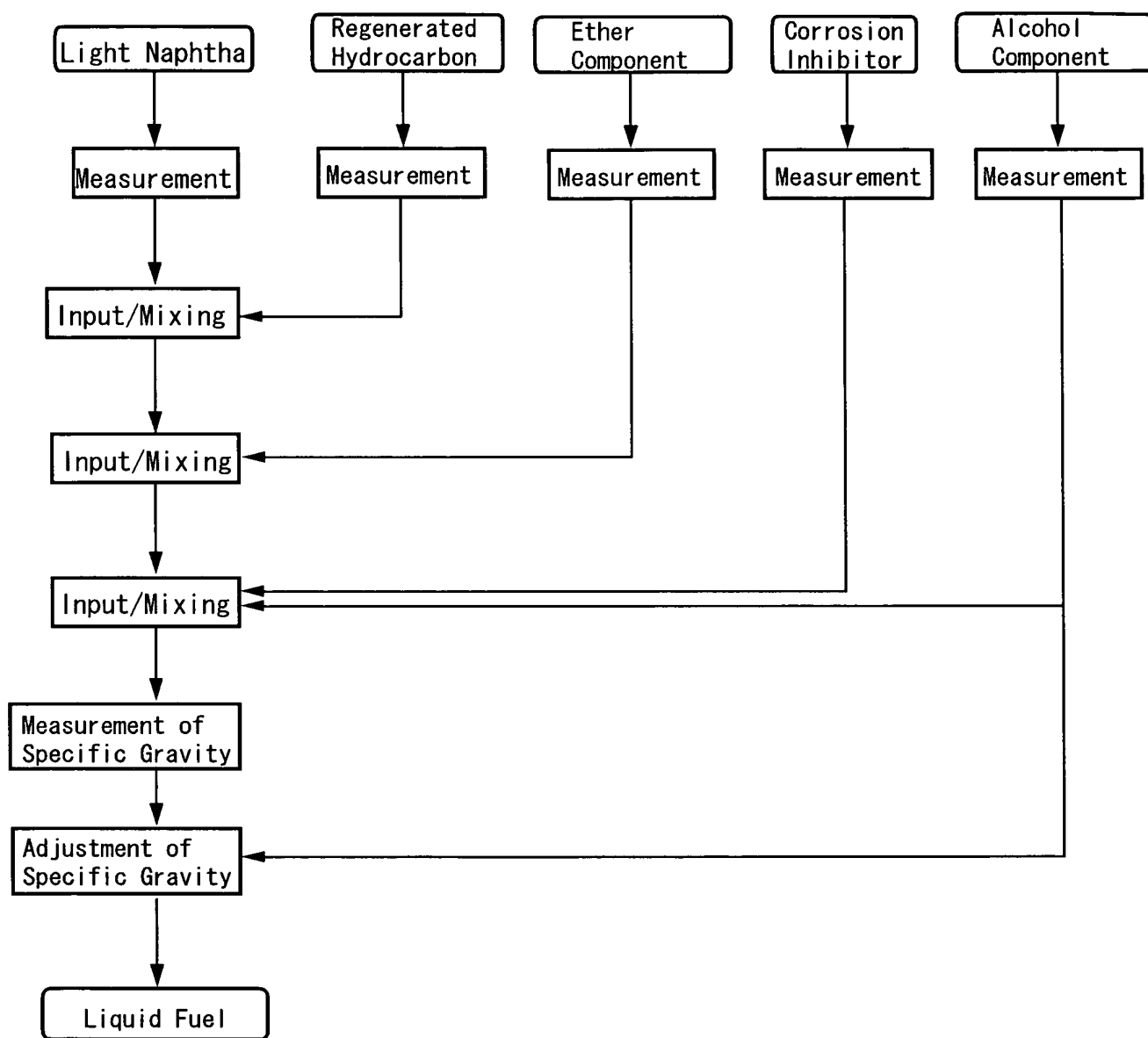
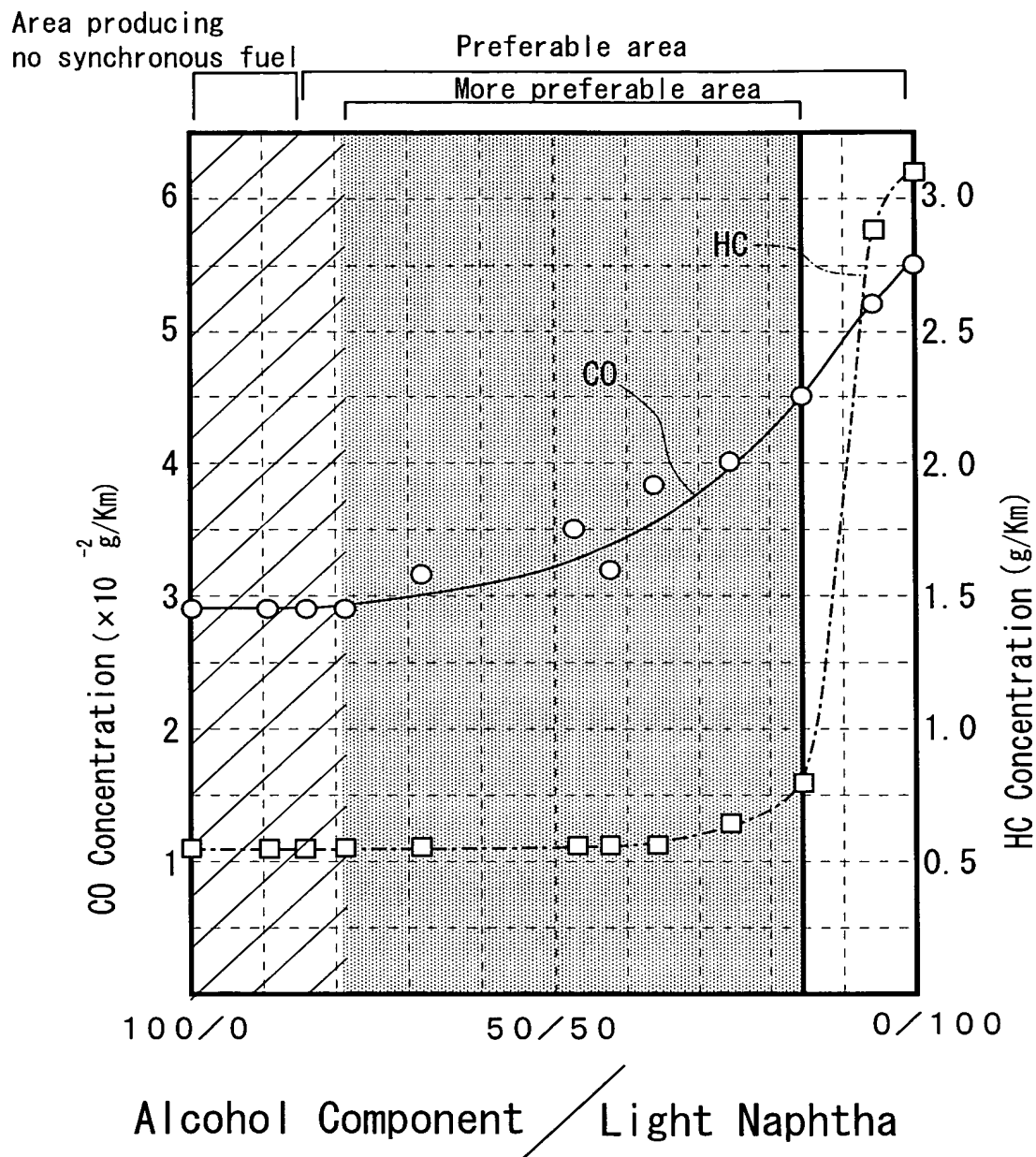


Fig. 2



Mixing Ratio (Alcohol/Ether/Naphtha)	100/0/0	85/5/10	80/5/15	75/5/20	65/5/30	40/5/55	45/5/50	35/5/60	25/5/70	15/5/80	5/5/90	0/0/100
Ratio (Alcohol/Naphtha)	100/0	89.5/10.5	84.2/15.8	78.9/21.1	68.4/31.6	42.1/57.9	47.4/52.6	36.8/63.2	26.3/73.7	15.8/84.2	5.3/94.7	0/100
HC Concentration (g/Km)	1.120	1.121	1.121	1.122	1.126	1.129	1.129	1.143	1.253	1.578	2.889	3.054
Co Concentration (g/Km)	0.029	0.029	0.029	0.029	0.032	0.032	0.035	0.038	0.040	0.045	0.051	0.055

Fig. 3

10/539080

<Ether Nonloaded Type>

Designation of Formulation	Fuel Composition						
	Naphtha	Ether	Alcohol				
			Ethanol	I P A	n B A	I B A	1-Pentanol
E 2	98		2				
E 1 0	90		10				
E 2 0	80		20				
E 5 0	50		50				
I N 4 0	60			20	20		
I N 1 5	85			10	5		
I N 7 5	25			35	40		
E I B 4 0	60		20			20	
E I B 1 5	85		5			10	
E I B 7 5	25		35			40	
P N B 3 0	70			10	10	10	
P N B 1 5	85			5	5	5	
P N B 7 5	25			25	25	25	
E I P P 3 0	70		10	10			10
E I P P 1 5	85		5	5			5
E I P P 7 5	25		25	25			25

<Ether Loaded Type>

Designation of Formulation	Fuel Composition						
	Naphtha	Ether	Alcohol				
			Ethanol	I P A	n B A	I B A	1-Pentano
E 1 0 - E	85	5	10				
E 2 0 - E	70	10	20				
E 5 0 - E	20	30	50				
I N 4 0 - E	30	30		20	20		
I N 1 5 - E	80	5		10	5		
I N 7 5 - E	20	5		35	40		
E I B 4 0 - E	30	30	20			20	
E I B 1 5 - E	80	5	5			10	
E I B 7 5 - E	20	5	35			40	
P N B 3 0 - E	40	30		10	10	10	
P N B 1 5 - E	80	5		5	5	5	
P N B 7 5 - E	20	5		25	25	25	
E I P P 3 0 - E	40	30	10	10			10
E I P P 1 5 - E	80	5	5	5			5
E I P P 7 5 - E	20	5	25	25			25

Fig. 4

Designation of Formulation	Fuel Composition (wt%)										Additive		Water		Aluminum Corrosion Test			Stability of Fuel*	
	H/C Naphtha	Alcohol								Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C		
		Ethanol	NPA	IPA	NBA	IBA	IBA	IBA	IBA										
E 10	90.0	10.0							None		0.0	100	120	5	100	100			
	89.9	10.0							None		0.1	100	120	0	100	100			
	90.0	10.0							None		0.0	120	24	100	100	100			
	89.6	10.0							None		0.4	120	24	0	100	0			
	89.6	10.0							None		0.5	120	24	0	0	0			
E 10-Me	89.6	10.0							Methanol	0.4	0.0	100	24	0	100	100			
	89.6	10.0								0.5	0.0	120	24	0	100	100			
E 10-PG	89.6	10.0							Propylene glycol	0.4	0.0	100	24	0	100	100			
	89.6	10.0								0.5	0.0	120	24	0	100	100			
E 10-DEK	86.9	9.7							Diethyl ketone	3.5	0.0	100	24	0	100	100			
	88.6	9.8								1.5	0.1	100	24	0	100	100			
	86.0	9.6								4.5	0.0	120	24	0	100	100			
	88.1	9.8								2.0	0.1	120	24	0	100	100			
	89.6	10.0								0.3	0.2	120	24	0	100	100			
	85.1	9.5								5.0	0.4	120	24	0	100	100			
E 10-GE	84.2	9.4								6.0	0.5	120	24	0	100	0			
	87.3	9.7							Ethyl formate	3.0	0.0	100	24	0	100	100			
	88.1	9.8								2.0	0.1	100	24	0	100	100			
	86.4	9.6								4.0	0.0	120	24	0	100	100			
	87.2	9.7								3.0	0.1	120	24	0	100	100			
E 10-PA	88.9	9.9								1.0	0.2	120	24	0	100	100			
	84.2	9.4								6.0	0.4	120	24	0	100	100			
	83.3	9.3								7.0	0.5	120	24	0	100	0			
	88.7	9.9							Propionaldehyde	1.5	0.0	100	24	0	100	100			
	89.0	9.9								1.0	0.1	100	24	0	100	100			
	88.2	9.8								2.0	0.0	120	24	0	100	100			
	89.0	9.9								1.0	0.1	120	24	0	100	100			
	89.4	9.9								0.5	0.2	120	24	0	100	100			
	86.0	9.6								4.0	0.4	120	24	0	100	100			
	85.1	9.5								5.0	0.5	120	24	0	100	0			

*1 100 → Perfectly phase-solved. 0 → Layer-separated

Fig. 5

Designation of Formulation	Fuel Composition (wt%)							Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*		
	HC Naphtha	Alcohol						Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
		Ethanol	NPA	IPA	NBA	I	B								
E20	80.0	20.0						None		0.0	100	120	7	100	100
	79.9	20.0						None		0.1	100	120	0	100	100
	80.0	20.0						None		0.0	120	24	100	100	100
	79.3	19.8						None		0.9	120	24	0	100	0
	79.1	19.8						None		1.1	120	24	0	0	0
E20-Me	79.6	19.9						Methanol	0.5	0.0	100	24	0	100	100
	79.6	19.9							0.5	0.0	120	24	0	100	100
E20-EG	79.6	19.9						Ethylene glycol	0.5	0.0	100	24	0	100	100
	79.6	19.9							0.5	0.0	120	24	0	100	100
E20-Ac	77.6	19.4						Acetone	3.0	0.0	100	24	0	100	100
	78.7	19.7							1.5	0.1	100	24	0	100	100
	76.8	19.2							4.0	0.0	120	24	0	100	100
	78.3	19.6							2.0	0.1	120	24	0	100	100
	79.6	19.9							0.3	0.2	120	24	0	100	100
E20-GM	75.3	18.8							5.0	0.9	120	24	0	100	100
	73.5	18.4							7.0	1.1	120	24	0	100	0
	75.2	18.8						Methyl formate	6.0	0.0	100	24	0	100	100
	77.5	19.4							3.0	0.1	100	24	0	100	100
	73.6	18.4							8.0	0.0	120	24	0	100	100
E20-BA	76.7	19.2							4.0	0.1	120	24	0	100	100
	78.2	19.6							2.0	0.2	120	24	0	100	100
	74.5	18.6							6.0	0.9	120	24	0	100	100
	72.7	18.2							8.0	1.1	120	24	0	100	0
	78.4	19.6						Butyraldehyde	2.0	0.0	100	24	0	100	100
	79.1	19.8							1.0	0.1	100	24	0	100	100
	78.0	19.5							2.5	0.0	120	24	0	100	100
	79.1	19.8							1.0	0.1	120	24	0	100	100
	79.4	19.9							0.5	0.2	120	24	0	100	100
	76.9	19.2							3.0	0.9	120	24	0	100	100
	75.9	19.0							4.0	1.1	120	24	0	100	0

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 6

Designation of Formulation	Fuel Composition (wt%)										Additive		Water		Aluminum Corrosion Test		Stability of Fuel*	
	H/C Naphtha	Alcohol								Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
		Ethanol	NPA	IPA	NBA	IBA	IBA	IBA	IBA									
E 50	50.0	50.0							None		0.0	100	120	100	100	100	100	
	49.9	50.0							None		0.1	100	120	0	100	100	100	
	50.0	50.0							None		0.0	120	24	100	100	100	100	
	48.3	48.3							None		3.4	120	24	0	100	0	0	
	48.2	48.2							None		3.6	120	24	0	0	0	0	
E 50-Me	49.6	49.6							Methanol	0.8	0.0	100	24	0	100	100	100	
	49.5	49.5								1.0	0.0	120	24	0	100	100	100	
E 50-EG	49.7	49.7							Ethylene glycol	0.7	0.0	100	24	0	100	100	100	
	49.5	49.5								1.0	0.0	120	24	0	100	100	100	
E 50-MEK	48.0	48.0							Methyl ethyl ketone	4.0	0.0	100	24	0	100	100	100	
	49.0	49.0								2.0	0.1	100	24	0	100	100	100	
	47.0	47.0								6.0	0.0	120	24	0	100	100	100	
	49.0	49.0								2.0	0.1	120	24	0	100	100	100	
	49.7	49.7								0.4	0.2	120	24	0	100	100	100	
	45.8	45.8								5.0	3.4	120	24	0	100	100	100	
	44.7	44.7								7.0	3.6	120	24	0	100	0	0	
E 50-GE	47.0	47.0							Ethyl formate	6.0	0.0	100	24	0	100	100	100	
	48.5	48.5								3.0	0.1	100	24	0	100	100	100	
	45.0	45.0								10.0	0.0	120	24	0	100	100	100	
	47.5	47.5								5.0	0.1	120	24	0	100	100	100	
	48.9	48.9								2.0	0.2	120	24	0	100	100	100	
	46.3	46.3								4.0	3.4	120	24	0	100	100	100	
	45.2	45.2								6.0	3.6	120	24	0	100	0	0	
E 50-AA	48.5	48.5							Acetaldehyde	3.0	0.0	100	24	0	100	100	100	
	49.2	49.2								1.5	0.1	100	24	0	100	100	100	
	48.0	48.0								4.0	0.0	120	24	0	100	100	100	
	49.0	49.0								2.0	0.1	120	24	0	100	100	100	
	49.4	49.4								1.0	0.2	120	24	0	100	100	100	
	47.3	47.3								2.0	3.4	120	24	0	100	100	100	
	46.7	46.7								3.0	3.6	120	24	0	100	0	0	

*1 100 —Perfectly phase-solved. 0 —Layer-separated

Fig. 7

Designation of Formulation	Fuel Composition (wt%)							Additive		Water		Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Alcohol						Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp 25° C	Low Temp. -10° C	
		Ethanol	NPA	IPA	NBA	IBA	I BA									
I N40	60.0			20.0	20.0			None		0.0	90	24	100	100	100	
	59.9			20.0	20.0			None		0.1	90	24	0	100	100	
	60.0			20.0	20.0			None		0.0	120	24	100	100	100	
	57.8			19.3	19.3			None		3.6	120	24	0	100	0	
	57.7			19.2	19.2			None		3.8	120	24	0	0	0	
I N40-Me	59.5			19.8	19.8			Methanol	0.8	0.0	100	24	0	100	100	
	59.6			19.9	19.9				0.4	0.2	100	24	0	100	100	
	59.0			19.7	19.7				1.7	0.0	120	24	0	100	100	
	59.3			19.8	19.8				1.0	0.2	120	24	0	100	100	
	59.5			19.8	19.8				0.5	0.4	120	24	0	100	100	
I N40-EG	57.2			19.1	19.1				1.0	3.6	120	24	0	100	100	
	56.5			18.8	18.8				2.0	3.8	120	24	0	100	0	
	59.1			19.7	19.7			Ethylene glycol	1.5	0.0	100	24	0	100	100	
	59.3			19.8	19.8				1.0	0.2	100	24	0	100	100	
	58.2			19.4	19.4				3.0	0.0	120	24	0	100	100	
I N40-Ac	58.7			19.6	19.6				2.0	0.2	120	24	0	100	100	
	59.2			19.7	19.7				1.0	0.4	120	24	0	100	100	
	59.9			20.0	20.0			Acetone	0.2	0.0	100	24	0	100	100	
	59.9			20.0	20.0				0.1	0.1	100	24	0	100	100	
	59.9			20.0	20.0				0.2	0.0	120	24	0	100	100	
I N40-GM	56.6			18.9	18.9				2.0	3.6	120	24	0	100	100	
	55.9			18.6	18.6				3.0	3.8	120	24	0	100	0	
	59.1			19.7	19.7			Methyl formate	1.5	0.0	100	24	0	100	100	
	59.5			19.8	19.8				0.8	0.1	100	24	0	100	100	
	58.2			19.4	19.4				3.0	0.0	120	24	0	100	100	
I N40-BA	59.3			19.8	19.8				1.0	0.2	120	24	0	100	100	
	59.5			19.8	19.8				0.5	0.3	120	24	0	100	100	
	56.6			18.9	18.9				2.0	3.6	120	24	0	100	100	
	55.9			18.6	18.6				3.0	3.8	120	24	0	100	0	
	59.8			19.9	19.9			Butylaldehyde	0.3	0.0	100	24	0	100	100	
I N40-BA	59.8			19.9	19.9				0.2	0.1	100	24	0	100	100	
	59.7			19.9	19.9				0.5	0.0	120	24	0	100	100	
	59.8			19.9	19.9				0.2	0.1	120	24	0	100	100	
	59.8			19.9	19.9				0.1	0.2	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 8

Designation of Formulation	Fuel Composition (wt%)							Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*1		
	HC Naphtha	Ethanol	Alcohol					Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			NPA	IPA	NBA	IBA									
I N15	85.0			10.0	5.0			None		0.0	90	24	10	100	100
	84.9			10.0	5.0			None		0.1	90	24	0	100	100
	85.0			10.0	5.0			None		0.0	120	24	100	100	100
	84.5			9.9	5.0			None		0.6	120	24	0	100	0
	84.3			9.9	5.0			None		0.8	120	24	0	0	0
I N15-Me	84.6			10.0	5.0			Methanol	0.5	0.0	100	24	0	100	100
	84.6			10.0	5.0				0.3	0.2	100	24	0	100	100
	83.7			9.9	4.9				1.5	0.0	120	24	0	100	100
	84.2			9.9	5.0				0.8	0.2	120	24	0	100	100
	84.3			9.9	5.0				0.5	0.3	120	24	0	100	100
	84.1			9.9	4.9				0.5	0.6	120	24	0	100	100
	83.5			9.8	4.9				1.0	0.8	120	24	0	100	0
I N15-PG	83.3			9.8	4.9			Propylene glycol	2.0	0.0	100	24	0	100	100
	84.0			9.9	4.9				1.0	0.2	100	24	0	100	100
	81.6			9.6	4.8				4.0	0.0	120	24	0	100	100
	83.1			9.8	4.9				2.0	0.2	120	24	0	100	100
	83.8			9.9	4.9				1.0	0.4	120	24	0	100	100
I N15-MBK	84.7			10.0	5.0			Methyl isobutyl ketone	0.3	0.0	100	24	0	100	100
	84.7			10.0	5.0				0.2	0.1	100	24	0	100	100
	84.6			10.0	5.0				0.5	0.0	120	24	0	100	100
	84.7			10.0	5.0				0.2	0.1	120	24	0	100	100
	84.1			9.9	4.9				0.5	0.6	120	24	0	100	100
	83.5			9.8	4.9				1.0	0.8	120	24	0	100	0
I N15-GE	84.2			9.9	5.0			Ethyl formate	1.0	0.0	100	24	0	100	100
	84.4			9.9	5.0				0.6	0.1	100	24	0	100	100
	80.8			9.5	4.8				5.0	0.0	120	24	0	100	100
	83.1			9.8	4.9				2.0	0.2	120	24	0	100	100
	83.8			9.9	4.9				1.0	0.4	120	24	0	100	100
	81.1			9.5	4.8				4.0	0.6	120	24	0	100	100
	80.1			9.4	4.7				5.0	0.8	120	24	0	100	0
I N15-PA	84.8			10.0	5.0			Propionaldehyde	0.2	0.0	100	24	0	100	100
	84.8			10.0	5.0				0.1	0.1	100	24	0	100	100
	84.7			10.0	5.0				0.4	0.0	120	24	0	100	100
	84.7			10.0	5.0				0.2	0.1	120	24	0	100	100
	84.7			10.0	5.0				0.1	0.2	120	24	0	100	100

*1 100 —Perfectly phase-solved. 0 —Layer-separated

Fig. 9

Designation of Formulation	Fuel Composition (wt%)							Additive		Water		Aluminum Corrosion Test			Stability of Fuel*	
	H/C Naphtha	Ethanol	Alcohol				Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C		
			N P A	I P A	N B A	I B A										
I N75	25.0			35.0	40.0		None		0.0	90	24	100	100	100		
	25.0			35.0	40.0		None		0.1	90	24	100	100	100		
	25.0			34.9	39.9		None		0.2	90	24	0	100	100		
	25.0			35.0	40.0		None		0.0	120	24	100	100	100		
I N75-Me	24.9			34.8	39.8		None		0.6	120	24	100	100	100		
	24.8			34.7	39.7		None		0.8	120	24	0	100	100		
	24.8			34.7	39.6				0.5	120	24	0	100	100		
	24.8			34.7	39.7		Methanol	1.0	0.0	100	24	0	100	100		
I N75-EG	24.8			34.7	39.7				0.5	100	24	0	100	100		
	24.5			34.3	39.2				2.0	120	24	0	100	100		
	24.7			34.5	39.5				1.0	120	24	0	100	100		
	24.8			34.7	39.6				0.5	120	24	0	100	100		
I N75-MPK	24.3			34.0	38.8		Ethylene glycol	3.0	0.0	100	24	0	100	100		
	24.4			34.2	39.1				2.0	100	24	0	100	100		
	23.5			32.9	37.6				6.0	120	24	0	100	100		
	23.9			33.5	38.3				4.0	120	24	0	100	100		
I N75-GE	24.4			34.1	39.0				2.0	120	24	0	100	100		
	25.0			34.9	39.9		Methyl-n-propyl ketone	0.2	0.0	100	24	0	100	100		
	25.0			34.9	39.9				0.1	100	24	0	100	100		
	25.0			34.9	39.9				0.2	120	24	0	100	100		
I N75-AA	24.5			34.3	39.2		Methyl formate	2.0	0.0	100	24	0	100	100		
	24.7			34.6	39.6				1.0	100	24	0	100	100		
	24.1			33.8	38.6				3.5	120	24	0	100	100		
	24.6			34.4	39.3				1.5	120	24	0	100	100		
I N75-AA	24.7			34.6	39.6				0.8	120	24	0	100	100		
	24.9			34.9	39.9		Acetaldehyde	0.3	0.0	100	24	0	100	100		
	24.9			34.9	39.9				0.2	100	24	0	100	100		
	24.9			34.8	39.8				0.6	120	24	0	100	100		
I N75-AA	24.9			34.9	39.8				0.3	120	24	0	100	100		
	24.9			34.9	39.8				0.2	120	24	0	100	100		

*1 100 → Perfectly phase-solved. 0 → Layer-separated

Fig. 10

Designation of Formulation	Fuel Composition (wt%)						Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*		
	H/C		Alcohol				Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	Ethanol	NPA	IPA	NBA	IBA								
E I B 40	60.0	20.0				20.0	None		0.0	90	24	100	100	100
	59.9	20.0				20.0			0.1	90	24	0	100	100
	60.0	20.0				20.0			0.0	120	24	100	100	100
	57.1	19.0				19.0			4.8	120	24	0	100	0
	56.9	19.0				19.0			5.1	120	24	0	0	0
E I B 40-Me	59.1	19.7				19.7	Methanol		0.0	100	24	0	100	100
	59.2	19.7				19.7			0.5	100	24	0	100	100
	58.8	19.6				19.6			0.0	120	24	0	100	100
	59.1	19.7				19.7			0.5	120	24	0	100	100
	59.1	19.7				19.7			1.0	120	24	0	100	100
E I B 40-E G	59.4	19.8				19.8	Ethylene glycol		0.0	100	24	0	100	100
	59.3	19.8				19.8			0.4	100	24	0	100	100
	58.8	19.6				19.6			0.0	120	24	0	100	100
	58.9	19.6				19.6			0.3	120	24	0	100	100
	59.1	19.7				19.7			0.5	120	24	0	100	100
E I B 40-Ac	59.9	20.0				20.0	Acetone		0.0	100	24	0	100	100
	59.9	20.0				20.0			0.1	100	24	0	100	100
	58.2	19.4				19.4			0.0	120	24	0	100	100
	59.3	19.8				19.8			0.2	120	24	0	100	100
	59.6	19.9				19.9			0.5	120	24	0	100	100
E I B 40-GM	55.3	18.4				18.4			4.8	120	24	0	100	100
	54.5	18.2				18.2			5.1	120	24	0	100	0
	58.5	19.5				19.5			0.0	100	24	0	100	100
	59.0	19.7				19.7			0.2	100	24	0	100	100
	57.0	19.0				19.0			0.0	120	24	0	100	100
E I B 40-BA	58.7	19.6				19.6			0.2	120	24	0	100	100
	59.1	19.7				19.7			0.5	120	24	0	100	100
	55.9	18.6				18.6			4.8	120	24	0	100	100
	55.1	18.4				18.4			5.1	120	24	0	100	0
	59.6	19.9				19.9			0.0	100	24	0	100	100
	59.6	19.9				19.9			0.5	100	24	0	100	100
	59.4	19.8				19.8			0.0	120	24	0	100	100
	59.6	19.9				19.9			0.5	120	24	0	100	100
	59.3	19.8				19.8			1.0	120	24	0	100	100
	56.5	18.8				18.8			4.8	120	24	0	100	100
	55.7	18.6				18.6	2.0	5.1	120	24	0	100	0	

*1 100 → Perfectly phase-solved. 0 → Layer-separated

Fig. 11

Designation of Formulation	Fuel Composition (wt%)										Additive		Water		Aluminum Corrosion Test		Stability of Fuel*	
	HC		Ethanol		Alcohol		NBA		IBA		Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	85.0	5.0	5.0	NPA	IPA	NBA	IBA										
EIB15		85.0	5.0						10.0		None	0.0		90	24	28	100	100
		84.9	5.0						10.0		None	0.1		90	24	0	100	100
		85.0	5.0						10.0		None	0.0		120	24	100	100	100
		84.5	5.0						9.9		None	0.6		120	24	0	100	0
		84.3	5.0						9.9		None	0.8		120	24	0	0	0
EIB15-Me		84.2	5.0						9.9		Methanol	1.0		100	24	0	100	100
		84.3	5.0						9.9			0.5		100	24	0	100	100
		83.7	4.9						9.9			1.5		120	24	0	100	100
		84.0	4.9						9.9			0.8		120	24	0	100	100
		84.0	4.9						9.9			0.6		120	24	0	100	100
EIB15-PG		83.0	4.9						9.8			1.5		120	24	0	100	0
		83.7	4.9						9.9			0.8		100	24	0	100	100
		82.5	4.9						9.7			3.0		120	24	0	100	100
		83.0	4.9						9.8			2.0		120	24	0	100	100
		83.7	4.9						9.9			1.0		120	24	0	100	100
EIB15-DEK		84.2	5.0						9.9		Diethyl ketone	1.0		100	24	0	100	100
		84.6	5.0						10.0			0.4		100	24	0	100	100
		83.7	4.9						9.9			1.5		120	24	0	100	100
		84.3	5.0						9.9			0.7		120	24	0	100	100
		84.6	5.0						10.0			0.2		120	24	0	100	100
EIB15-SM		82.4	4.8						9.7			2.5		120	24	0	100	100
		81.3	4.8						9.6			3.5		120	24	0	100	0
		83.3	4.9						9.8		Methyl acetate	2.0		100	24	0	100	100
		83.9	4.9						9.9			1.0		100	24	0	100	100
		82.5	4.9						9.7			3.0		120	24	0	100	100
EIB15-PA		83.6	4.9						9.8			1.5		120	24	0	100	100
		84.0	4.9						9.9			0.7		120	24	0	100	100
		81.9	4.8						9.6			3.0		120	24	0	100	100
		80.9	4.8						9.5			4.0		120	24	0	100	0
		84.5	5.0						9.9		Propionaldehyde	0.6		100	24	0	100	100
EIB15-PA		84.7	5.0						10.0			0.1		100	24	0	100	100
		84.2	5.0						9.9			1.0		120	24	0	100	100
		84.5	5.0						9.9			0.4		120	24	0	100	100
		84.5	5.0						9.9			0.2		120	24	0	100	100
		84.5	5.0						9.9			0.2		120	24	0	100	100

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 12

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	Alcohol										Loading/Fuel (wt%)	Evaluation Temp. (°C)		Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	HC Naphtha	Ethanol	N	P	A	I	P	A	N	B			A				
EIB75	25.0	35.0									40.0	None	0.0	90	24	100	100
	25.0	34.9									40.0	None	0.1	90	24	100	100
	25.0	34.9									39.9	None	0.2	90	24	0	100
	25.0	35.0									40.0	None	0.0	120	24	100	100
EIB75-Me	24.8	34.7									39.6	None	1.0	120	24	100	100
	24.7	34.6									39.5	None	1.2	120	24	0	100
	24.6	34.5									39.4	Methanol	0.0	100	24	0	100
	24.6	34.5									39.4		0.5	100	24	0	100
E I B75-EC	24.5	34.3									39.2		0.0	120	24	0	100
	24.5	34.3									39.2		0.5	120	24	0	100
	24.5	34.3									39.2		1.0	120	24	0	100
	24.3	34.0									38.8	Ethylene glycol	0.0	100	24	0	100
EIB75-MEK	24.5	34.3									39.2		0.4	100	24	0	100
	23.8	33.3									38.0		0.0	120	24	0	100
	24.2	33.8									38.7		0.3	120	24	0	100
	24.4	34.1									39.0		0.5	120	24	0	100
EIB75-MEK	24.3	34.0									38.8	Methyl ethyl ketone	0.0	100	24	0	100
	24.9	34.8									39.8		0.3	100	24	0	100
	23.8	33.3									38.0		0.0	120	24	0	100
	24.5	34.2									39.1		0.2	120	24	0	100
E I B75-GM	24.7	34.6									39.5		1.0	120	24	0	100
	24.0	33.6									38.4	Methyl formate	0.0	100	24	0	100
	24.4	34.2									39.1		0.3	100	24	0	100
	23.0	32.2									36.8		0.0	120	24	0	100
EIB75-AA	23.9	33.5									38.3		0.3	120	24	0	100
	24.4	34.1									39.0		0.5	120	24	0	100
	24.8	34.7									39.7	Acetaldehyde	0.0	100	24	0	100
	24.9	34.8									39.8		0.3	100	24	0	100
EIB75-AA	24.8	34.7									39.6		0.0	120	24	0	100
	24.8	34.8									39.7		0.3	120	24	0	100
	24.8	34.8									39.7		0.5	120	24	0	100
	24.8	34.8									39.7		0.2	120	24	0	100

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 13

Designation of Formulation	Fuel Composition (wt%)							Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphthalene	Ethanol	Alcohol			NBA	IBA	Kind	Loading/Fuel (wt%)		Evaluation Temp.(°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			NPA	IPA	NBA										
PNB30	70.0		10.0	10.0	10.0	10.0	None		0.0	80	120	19	100	100	
	69.9		10.0	10.0	10.0	10.0	None		0.1	80	120	0	100	100	
	70.0		10.0	10.0	10.0	10.0	None		0.0	120	24	100	100	100	
	68.7		9.8	9.8	9.8	9.8	None		1.8	120	24	0	100	0	
	68.6		9.8	9.8	9.8	9.8	None		2.0	120	24	0	0	0	
PNB30-Me	69.3		9.9	9.9	9.9	9.9	Methanol	1.0	0.0	100	24	0	100	100	
	69.5		9.9	9.9	9.9	9.9		0.4	0.3	100	24	0	100	100	
	69.0		9.9	9.9	9.9	9.9		1.5	0.0	120	24	0	100	100	
	69.2		9.9	9.9	9.9	9.9		1.0	0.2	120	24	0	100	100	
	69.4		9.9	9.9	9.9	9.9		0.5	0.3	120	24	0	100	100	
	68.0		9.7	9.7	9.7	9.7		1.0	1.8	120	24	0	100	100	
	67.2		9.6	9.6	9.6	9.6		2.0	2.0	120	24	0	100	0	
PNB30-E G	68.6		9.8	9.8	9.8	9.8	Ethylene glycol	2.0	0.0	100	24	0	100	100	
	69.2		9.9	9.9	9.9	9.9		1.0	0.2	100	24	0	100	100	
	68.3		9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100	100	
	68.8		9.8	9.8	9.8	9.8		1.5	0.2	120	24	0	100	100	
	69.1		9.9	9.9	9.9	9.9		1.0	0.3	120	24	0	100	100	
PNB30-Ac	69.9		10.0	10.0	10.0	10.0	Acetone	0.2	0.0	100	24	0	100	100	
	69.9		10.0	10.0	10.0	10.0		0.1	0.1	100	24	0	100	100	
	69.9		10.0	10.0	10.0	10.0		0.2	0.0	120	24	0	100	100	
	69.9		10.0	10.0	10.0	10.0		0.1	0.1	120	24	0	100	100	
	67.3		9.6	9.6	9.6	9.6		2.0	1.8	120	24	0	100	100	
66.5		9.5	9.5	9.5	9.5		3.0	2.0	120	24	0	100	0		
PNB30-GM	69.0		9.9	9.9	9.9	9.9	Methyl formate	1.5	0.0	100	24	0	100	100	
	69.2		9.9	9.9	9.9	9.9		1.0	0.2	100	24	0	100	100	
	68.3		9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100	100	
	68.8		9.8	9.8	9.8	9.8		1.5	0.2	120	24	0	100	100	
	69.4		9.9	9.9	9.9	9.9		0.6	0.3	120	24	0	100	100	
66.6		9.5	9.5	9.5	9.5		3.0	1.8	120	24	0	100	100		
65.5		9.4	9.4	9.4	9.4		4.5	2.0	120	24	0	100	0		
PNB30-BA	69.7		10.0	10.0	10.0	10.0	Acetaldehyde	0.4	0.0	100	24	0	100	100	
	69.8		10.0	10.0	10.0	10.0		0.1	0.2	100	24	0	100	100	
	69.7		10.0	10.0	10.0	10.0		0.5	0.0	120	24	0	100	100	
	69.7		10.0	10.0	10.0	10.0		0.2	0.3	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 14

Designation of Formulation	Fuel Composition (wt%)							Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*			
	HC Naphthalene	Alcohol			Ethanol	NPA	IPA	NBA	IBA		Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
PNB15	85.0		5.0	5.0	5.0	5.0			None		0.0	80	120	1	100	100	
	84.9		5.0	5.0	5.0	5.0			None		0.1	80	120	0	100	100	
	85.0		5.0	5.0	5.0	5.0			None		0.0	120	24	100	100	100	
	84.6		5.0	5.0	5.0	5.0			None		0.5	120	24	0	100	0	
	84.4		5.0	5.0	5.0	5.0			None		0.7	120	24	0	0	0	
PNB15-Me	84.3		5.0	5.0	5.0	5.0			Methanol	0.8	0.0	100	24	0	100	100	
	84.5		5.0	5.0	5.0	5.0				0.4	0.2	100	24	0	100	100	
	83.7		4.9	4.9	4.9	4.9				1.5	0.0	120	24	0	100	100	
	84.0		4.9	4.9	4.9	4.9				1.0	0.2	120	24	0	100	100	
	84.3		5.0	5.0	5.0	5.0				0.5	0.3	120	24	0	100	100	
PNB15-PG	82.9		4.9	4.9	4.9	4.9				2.0	0.5	120	24	0	100	100	
	81.9		4.8	4.8	4.8	4.8				3.0	0.7	120	24	0	100	0	
	82.5		4.9	4.9	4.9	4.9			Propylene glycol	3.0	0.0	100	24	0	100	100	
	83.6		4.9	4.9	4.9	4.9				1.5	0.2	100	24	0	100	100	
	81.6		4.8	4.8	4.8	4.8				4.0	0.0	120	24	0	100	100	
PNB15-MPK	83.1		4.9	4.9	4.9	4.9				2.0	0.2	120	24	0	100	100	
	83.9		4.9	4.9	4.9	4.9				1.0	0.3	120	24	0	100	100	
	84.7		5.0	5.0	5.0	5.0			Methyl-n-propyl ketone	0.3	0.0	100	24	0	100	100	
	84.7		5.0	5.0	5.0	5.0				0.2	0.1	100	24	0	100	100	
	84.6		5.0	5.0	5.0	5.0				0.5	0.0	120	24	0	100	100	
PNB15-SM	81.2		4.8	4.8	4.8	4.8				4.0	0.5	120	24	0	100	100	
	80.2		4.7	4.7	4.7	4.7				5.0	0.7	120	24	0	100	0	
	83.7		4.9	4.9	4.9	4.9			Methyl acetate	1.5	0.0	100	24	0	100	100	
	84.0		4.9	4.9	4.9	4.9				1.0	0.2	100	24	0	100	100	
	79.9		4.7	4.7	4.7	4.7				6.0	0.0	120	24	0	100	100	
PNB15-AA	82.3		4.8	4.8	4.8	4.8				3.0	0.2	120	24	0	100	100	
	83.9		4.9	4.9	4.9	4.9				1.0	0.3	120	24	0	100	100	
	79.5		4.7	4.7	4.7	4.7				6.0	0.5	120	24	0	100	100	
	78.5		4.6	4.6	4.6	4.6				7.0	0.7	120	24	0	100	0	
	84.7		5.0	5.0	5.0	5.0			Acetaldehyde	0.3	0.0	100	24	0	100	100	
	84.7		5.0	5.0	5.0	5.0				0.2	0.1	100	24	0	100	100	
	84.6		5.0	5.0	5.0	5.0				0.5	0.0	120	24	0	100	100	
	84.7		5.0	5.0	5.0	5.0				0.2	0.2	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 15

Designation of Formulation	Fuel Composition (wt%)								Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Alcohol						Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
		Ethanol	NPA	IPA	NBA	IBA	IBA									
PNB75	25.0			25.0	25.0	25.0	25.0	None		0.0	80	120	100	100	100	
	25.0			24.9	25.0	25.0	25.0	None		0.1	80	120	85	100	100	
	25.0			24.9	24.9	25.0	25.0	None		0.2	80	120	0	100	100	
	25.0			25.0	25.0	25.0	25.0	None		0.0	120	24	100	100	100	
	22.5			22.5	22.5	22.5	22.5	None		10.0	120	24	0	100	0	
PNB75-Me	22.4			22.4	22.4	22.4	22.4	None		10.5	120	24	0	0	0	
	24.8			24.8	24.8	24.8	24.8	Methanol	1.0	0.0	100	24	0	100	100	
	24.8			24.8	24.8	24.8	24.8		0.4	0.3	100	24	0	100	100	
	24.5			24.5	24.5	24.5	24.5		2.0	0.0	120	24	0	100	100	
	24.6			24.6	24.6	24.6	24.6		1.5	0.2	120	24	0	100	100	
PNB75-E-G	24.7			24.7	24.7	24.7	24.7		0.8	0.4	120	24	0	100	100	
	22.0			22.0	22.0	22.0	22.0		2.0	10.0	120	24	0	100	100	
	21.6			21.6	21.6	21.6	21.6		3.0	10.5	120	24	0	100	0	
	24.0			24.0	24.0	24.0	24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100	
	24.4			24.4	24.4	24.4	24.4		2.0	0.3	100	24	0	100	100	
PNB75-MEK	23.5			23.5	23.5	23.5	23.5		6.0	0.0	120	24	0	100	100	
	24.2			24.2	24.2	24.2	24.2		3.0	0.3	120	24	0	100	100	
	24.4			24.4	24.4	24.4	24.4		2.0	0.4	120	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9	Methyl ethyl ketone	0.3	0.0	100	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9		0.1	0.2	100	24	0	100	100	
PNB75-GE	24.9			24.9	24.9	24.9	24.9		0.5	0.0	120	24	0	100	100	
	21.8			21.8	21.8	21.8	21.8		0.2	0.2	120	24	0	100	100	
	21.4			21.4	21.4	21.4	21.4		3.0	10.0	120	24	0	100	100	
	24.0			24.0	24.0	24.0	24.0		4.0	10.5	120	24	0	100	0	
	24.5			24.5	24.5	24.5	24.5	Ethyl formate	4.0	0.0	100	24	0	100	100	
PNB75-PA	23.5			23.5	23.5	23.5	23.5		6.0	0.0	120	24	0	100	100	
	24.2			24.2	24.2	24.2	24.2		3.0	0.2	120	24	0	100	100	
	24.7			24.7	24.7	24.7	24.7		1.0	0.4	120	24	0	100	100	
	21.5			21.5	21.5	21.5	21.5		4.0	10.0	120	24	0	100	100	
	21.1			21.1	21.1	21.1	21.1		5.0	10.5	120	24	0	100	0	
PNB75-PA	24.9			24.9	24.9	24.9	24.9	Propionaldehyde	0.3	0.0	100	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9		0.1	0.2	100	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9		0.5	0.0	120	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9		0.2	0.2	120	24	0	100	100	
	24.9			24.9	24.9	24.9	24.9									

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 16

Designation of Formulation	Fuel Composition (wt%)						Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel**	
	Naphtha			Alcohol			Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Ethanol	NPA	IPA	NBA										
EIPP30	70.0	10.0		10.0			None		0.0	80	120	51	100	100
	69.9	10.0		10.0			None		0.1	80	120	0	100	100
	70.0	10.0		10.0			None		0.0	120	24	100	100	100
	68.3	9.8		9.8			None		2.5	120	24	0	100	0
	67.9	9.7		9.7			None		3.0	120	24	0	0	0
EIPP30-Me	69.0	9.9		9.9			Methanol	1.5	0.0	100	24	0	100	100
	69.4	9.9		9.9				0.5	0.4	100	24	0	100	100
	68.3	9.8		9.8				2.5	0.0	120	24	0	100	100
	68.6	9.8		9.8				1.5	0.5	120	24	0	100	100
	69.0	9.9		9.9				0.5	1.0	120	24	0	100	100
EIPP30-EG	68.6	9.8		9.8			Ethylene glycol	2.0	0.0	100	24	0	100	100
	69.0	9.9		9.9				1.0	0.4	100	24	0	100	100
	66.5	9.5		9.5				5.0	0.0	120	24	0	100	100
	67.5	9.6		9.6				3.0	0.6	120	24	0	100	100
	67.9	9.7		9.7				2.0	1.0	120	24	0	100	100
EIPP30-Ac	67.9	9.7		9.7			Acetone	3.0	0.0	100	24	0	100	100
	69.7	10.0		10.0				0.2	0.3	100	24	0	100	100
	67.2	9.6		9.6				4.0	0.0	120	24	0	100	100
	69.2	9.9		9.9				1.0	0.2	120	24	0	100	100
								0.2	0.5	120	24	0	100	100
EIPP30-OM	64.1	9.2		9.2				6.0	2.5	120	24	0	100	100
	63.0	9.0		9.0				7.0	3.0	120	24	0	100	0
	69.0	9.9		9.9			Methyl formate	1.5	0.0	100	24	0	100	100
	69.2	9.9		9.9				1.0	0.2	100	24	0	100	100
	65.8	9.4		9.4				6.0	0.0	120	24	0	100	100
EIPP30-BA	69.0	9.9		9.9				1.0	0.5	120	24	0	100	100
	69.2	9.9		9.9				0.2	1.0	120	24	0	100	100
	63.4	9.1		9.1				7.0	2.5	120	24	0	100	100
	62.3	8.9		8.9				8.0	3.0	120	24	0	100	0
	69.6	9.9		9.9			Butylaldehyde	0.6	0.0	100	24	0	100	100
	69.7	10.0		10.0				0.2	0.3	100	24	0	100	100
	69.3	9.9		9.9				1.0	0.0	120	24	0	100	100
	69.5	9.9		9.9				0.2	0.5	120	24	0	100	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 17

Designation of Formulation	Fuel Composition (wt%)						Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	HC Naphthalene	Alcohol				Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
		Ethanol	NPA	IPA	NBA								
EIPPI5	85.0	5.0		5.0		None		0.0	80	120	16	100	100
	84.9	5.0		5.0		None		0.1	80	120	0	100	100
	85.0	5.0		5.0		None		0.0	120	24	100	100	100
	84.3	5.0		5.0		None		0.8	120	24	0	100	0
	84.2	5.0		5.0		None		1.0	120	24	0	0	0
EIPPI5-Me	84.2	5.0		5.0		Methanol	1.0	0.0	100	24	0	100	100
	84.2	5.0		5.0			0.5	0.4	100	24	0	100	100
	83.3	4.9		4.9			2.0	0.0	120	24	0	100	100
	83.8	4.9		4.9			1.0	0.4	120	24	0	100	100
	84.1	4.9		4.9			0.5	0.6	120	24	0	100	100
EIPPI5-PG	82.9	4.9		4.9		Propylene glycol	2.5	0.0	100	24	0	100	100
	83.5	4.9		4.9			1.5	0.3	100	24	0	100	100
	81.6	4.8		4.8			4.0	0.0	120	24	0	100	100
	83.0	4.9		4.9			2.0	0.4	120	24	0	100	100
	83.3	4.9		4.9			1.5	0.5	120	24	0	100	100
EIPPI5-DEK	83.3	4.9		4.9		Diethyl ketone	2.0	0.0	100	24	0	100	100
	84.6	5.0		5.0			0.2	0.3	100	24	0	100	100
	82.5	4.9		4.9			3.0	0.0	120	24	0	100	100
	84.2	5.0		5.0			0.8	0.2	120	24	0	100	100
	84.4	5.0		5.0			0.2	0.5	120	24	0	100	100
EIPPI5-SM	80.9	4.8		4.8			4.0	0.8	120	24	0	100	100
	79.9	4.7		4.7			5.0	1.0	120	24	0	100	0
	84.0	4.9		4.9		Methyl acetate	1.2	0.0	100	24	0	100	100
	84.2	5.0		5.0			0.7	0.2	100	24	0	100	100
	81.6	4.8		4.8			4.0	0.0	120	24	0	100	100
EIPPI5-PA	83.8	4.9		4.9			1.0	0.4	120	24	0	100	100
	84.2	5.0		5.0			0.2	0.8	120	24	0	100	100
	80.1	4.7		4.7			5.0	0.8	120	24	0	100	100
	79.1	4.7		4.7			6.0	1.0	120	24	0	100	0
	84.6	5.0		5.0		Propionaldehyde	0.5	0.0	100	24	0	100	100
	84.6	5.0		5.0			0.2	0.3	100	24	0	100	100
	84.3	5.0		5.0			0.8	0.0	120	24	0	100	100
	84.5	5.0		5.0			0.2	0.4	120	24	0	100	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 18

Designation of Formulation	Fuel Composition (wt%)						Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC	Alcohol					Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
		Ethanol	NPA	IPA	NBA									
EIPP75	25.0	25.0		25.0			None		0.0	80	120	100	100	100
	25.0	24.9		25.0			None		0.1	80	120	55	100	100
	25.0	24.9		24.9			None		0.2	80	120	0	100	100
	25.0	25.0		25.0			None		0.0	120	24	100	100	100
	24.6	24.6		24.6			None		1.5	120	24	100	100	100
	24.6	24.6		24.6			None		1.7	120	24	0	100	100
EIPP75-Me	24.5	24.5		24.5			Methanol	2.0	0.0	100	24	0	100	100
	24.6	24.6		24.6				1.0	0.5	100	24	0	100	100
	24.3	24.3		24.3				3.0	0.0	120	24	0	100	100
	24.4	24.4		24.4				2.0	0.5	120	24	0	100	100
	24.6	24.6		24.6				0.6	1.0	120	24	0	100	100
EIPP75-E G	24.0	24.0		24.0			Ethylene glycol	4.0	0.0	100	24	0	100	100
	24.4	24.4		24.4				2.0	0.5	100	24	0	100	100
	23.0	23.0		23.0				8.0	0.0	120	24	0	100	100
	23.6	23.6		23.6				5.0	0.5	120	24	0	100	100
	24.0	24.0		24.0				3.0	1.0	120	24	0	100	100
EIPP75-MEK	24.3	24.3		24.3			Methy ethyl ketone	3.0	0.0	100	24	0	100	100
	24.9	24.9		24.9				0.2	0.3	100	24	0	100	100
	23.8	23.8		23.8				5.0	0.0	120	24	0	100	100
	24.7	24.7		24.7				1.0	0.2	120	24	0	100	100
	24.8	24.8		24.8				0.2	0.5	120	24	0	100	100
EIPP75-GM	24.3	24.3		24.3			Methyl formate	3.0	0.0	100	24	0	100	100
	24.4	24.4		24.4				2.0	0.4	100	24	0	100	100
	22.8	22.8		22.8				9.0	0.0	120	24	0	100	100
	24.4	24.4		24.4				2.0	0.5	120	24	0	100	100
	24.6	24.6		24.6				0.5	1.0	120	24	0	100	100
EIPP75-AA	24.9	24.9		24.9			Acetaldehyde	0.5	0.0	100	24	0	100	100
	24.9	24.9		24.9				0.2	0.2	100	24	0	100	100
	24.8	24.8		24.8				1.0	0.0	120	24	0	100	100
	24.8	24.8		24.8				0.2	0.5	120	24	0	100	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 19

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol							Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA										
E10-E	85.0	5.0	10.0						None		100	120	2	100	100		
	84.9	5.0	10.0						None		100	120	0	100	100		
	85.0	5.0	10.0						None		120	24	89	100	100		
	84.7	5.0	10.0						None		120	24	0	100	0		
	84.6	5.0	10.0						None		120	24	0	0	0		
E10-E-Me	84.7	5.0	10.0						Methanol	0.4	100	24	0	100	100		
	84.6	5.0	10.0							0.5	120	24	0	100	100		
E10-E-PG	84.7	5.0	10.0						Propylene glycol	0.4	100	24	0	100	100		
	84.6	5.0	10.0							0.5	120	24	0	100	100		
E10-E-DEK	82.0	4.8	9.7						Diethyl ketone	3.5	100	24	0	100	100		
	83.6	4.9	9.8							1.5	100	24	0	100	100		
	81.2	4.8	9.6							4.5	120	24	0	100	100		
	83.2	4.9	9.8							2.0	120	24	0	100	100		
	84.6	5.0	10.0							0.3	120	24	0	100	100		
	80.4	4.7	9.5							5.0	120	24	0	100	100		
	79.5	4.7	9.4							6.0	120	24	0	100	0		
E10-E-GE	82.5	4.9	9.7						Ethyl formate	3.0	100	24	0	100	100		
	83.2	4.9	9.8							2.0	100	24	0	100	100		
	81.6	4.8	9.6							4.0	120	24	0	100	100		
	82.4	4.8	9.7							3.0	120	24	0	100	100		
	84.0	4.9	9.9							1.0	120	24	0	100	100		
	79.6	4.7	9.4							6.0	120	24	0	100	100		
	78.6	4.6	9.3							7.0	120	24	0	100	0		
E10-E-PA	83.7	4.9	9.9						Propionald ethide	1.5	100	24	0	100	100		
	84.1	4.9	9.9							1.0	100	24	0	100	100		
	83.3	4.9	9.8							2.0	120	24	0	100	100		
	84.1	4.9	9.9							1.0	120	24	0	100	100		
	84.4	5.0	9.9							0.5	120	24	0	100	100		
	81.3	4.8	9.6							4.0	120	24	0	100	100		
	80.3	4.7	9.5							5.0	120	24	0	100	0		

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 20

Designation of Formulation	Fuel Composition (wt%)								Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol					Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
			Ethanol	NPA	IPA	NBA	IBA									
E20-E	70.0	10.0	20.0					None		0.0	100	120	8	100	100	
	69.9	10.0	20.0					None		0.1	100	120	0	100	100	
	70.0	10.0	20.0					None		0.0	120	24	100	100	100	
	69.0	9.9	19.7					None		1.5	120	24	0	100	0	
	68.8	9.8	19.7					None		1.7	120	24	0	0	0	
E20-E-Me	69.7	10.0	19.9					Methanol	0.5	0.0	100	24	0	100	100	
	69.7	10.0	19.9						0.5	0.0	120	24	0	100	100	
E20-E-EG	69.7	10.0	19.9					Ethylene glycol	0.5	0.0	100	24	0	100	100	
	69.7	10.0	19.9						0.5	0.0	120	24	0	100	100	
E20-E-Ac	67.9	9.7	19.4					Acetone	3.0	0.0	100	24	0	100	100	
	68.9	9.8	19.7						1.5	0.1	100	24	0	100	100	
	67.2	9.6	19.2						4.0	0.0	120	24	0	100	100	
	68.5	9.8	19.6						2.0	0.1	120	24	0	100	100	
	69.7	10.0	19.9						0.3	0.2	120	24	0	100	100	
	65.5	9.4	18.7						5.0	1.5	120	24	0	100	100	
	63.9	9.1	18.3						7.0	1.7	120	24	0	100	0	
E20-E-GM	65.8	9.4	18.8					Methyl formate	6.0	0.0	100	24	0	100	100	
	67.8	9.7	19.4						3.0	0.1	100	24	0	100	100	
	64.4	9.2	18.4						8.0	0.0	120	24	0	100	100	
	67.1	9.6	19.2						4.0	0.1	120	24	0	100	100	
	68.5	9.8	19.6						2.0	0.2	120	24	0	100	100	
	64.8	9.3	18.5						6.0	1.5	120	24	0	100	100	
	63.2	9.0	18.1						8.0	1.7	120	24	0	100	0	
E20-E-BA	68.6	9.8	19.6					Butylaldehyde	2.0	0.0	100	24	0	100	100	
	69.2	9.9	19.8						1.0	0.1	100	24	0	100	100	
	68.3	9.8	19.5						2.5	0.0	120	24	0	100	100	
	69.2	9.9	19.8						1.0	0.1	120	24	0	100	100	
	69.5	9.9	19.9						0.5	0.2	120	24	0	100	100	
	66.9	9.6	19.1						3.0	1.5	120	24	0	100	100	
	66.0	9.4	18.9						4.0	1.7	120	24	0	100	0	

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 21

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel #1	
	HC		Ether		Alcohol						Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C
	Naphtha	ETBE	Ethanol	NPA	IPA	NBA	IBA										
E50-E	20.0	30.0	50.0							None		0.0	100	120	81	100	100
	20.0	30.0	49.9							None		0.1	100	120	0	100	100
	20.0	30.0	50.0							None		0.0	120	24	100	100	100
	17.5	26.3	43.8							None		12.5	120	24	0	100	0
	17.4	26.1	43.5							None		13.0	120	24	0	0	0
E50-E-Me	19.8	29.8	49.6							Methanol	0.8	0.0	100	24	0	100	100
	19.8	29.7	49.5								1.0	0.0	120	24	0	100	100
E50-E-EG	19.9	29.8	49.7							Ethylene glycol	0.7	0.0	100	24	0	100	100
	19.8	29.7	49.5								1.0	0.0	120	24	0	100	100
E50-E-MEK	19.2	28.8	48.0							Methyl ethyl ketone	4.0	0.0	100	24	0	100	100
	19.6	29.4	49.0								2.0	0.1	100	24	0	100	100
	18.8	28.2	47.0								6.0	0.0	120	24	0	100	100
	19.6	29.4	49.0								2.0	0.1	120	24	0	100	100
	19.9	29.8	49.7								0.4	0.2	120	24	0	100	100
	16.5	24.8	41.3								5.0	12.5	120	24	0	100	100
	16.0	24.0	40.0								7.0	13.0	120	24	0	100	0
E50-E-GE	18.8	28.2	47.0							Ethyl formate	6.0	0.0	100	24	0	100	100
	19.4	29.1	48.5								3.0	0.1	100	24	0	100	100
	18.0	27.0	45.0								10.0	0.0	120	24	0	100	100
	19.0	28.5	47.5								5.0	0.1	120	24	0	100	100
	19.6	29.3	48.9								2.0	0.2	120	24	0	100	100
E50-E-AA	16.7	25.1	41.8								4.0	12.5	120	24	0	100	100
	16.2	24.3	40.5								6.0	13.0	120	24	0	100	0
	19.4	29.1	48.5							Acetaldehyde	3.0	0.0	100	24	0	100	100
	19.7	29.5	49.2								1.5	0.1	100	24	0	100	100
	19.2	28.8	48.0								4.0	0.0	120	24	0	100	100
	19.6	29.4	49.0								2.0	0.1	120	24	0	100	100
	19.8	29.6	49.4								1.0	0.2	120	24	0	100	100
	17.1	25.7	42.8								2.0	12.5	120	24	0	100	100
	16.8	25.2	42.0								3.0	13.0	120	24	0	100	0

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 22

Designation of Formulation	Fuel Composition (wt%)								Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol				Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)		Weight Loss Rate (%)	Room Temp 25° C	Low Temp. -10° C	
			Ethanol	NPA	IPA	NBA									IBA
IN40-E	30.0	30.0		20.0	20.0		None		0.0	90	24	100	100		
	30.0	30.0		19.9	20.0		None		0.1	90	24	0	100		
	30.0	30.0		20.0	20.0		None		0.0	120	24	100	100		
	28.4	28.4		18.9	18.9		None		5.5	120	24	0	100		
	28.3	28.3		18.8	18.8		None		5.8	120	24	0	0		
IN40-E-Me	29.8	29.8		19.8	19.8		Methanol	0.8	0.0	100	24	0	100		
	29.8	29.8		19.9	19.9			0.4	0.2	100	24	0	100		
	29.5	29.5		19.7	19.7			1.7	0.0	120	24	0	100		
	29.6	29.6		19.8	19.8			1.0	0.2	120	24	0	100		
	29.7	29.7		19.8	19.8			0.5	0.4	120	24	0	100		
IN40-E-E-G	28.1	28.1		18.7	18.7			1.0	5.5	120	24	0	100		
	27.7	27.7		18.4	18.4			2.0	5.8	120	24	0	100		
	29.6	29.6		19.7	19.7		Ethylene glycol	1.5	0.0	100	24	0	100		
	29.6	29.6		19.8	19.8			1.0	0.2	100	24	0	100		
	29.1	29.1		19.4	19.4			3.0	0.0	120	24	0	100		
IN40-E-Ac	29.3	29.3		19.6	19.6			2.0	0.2	120	24	0	100		
	29.6	29.6		19.7	19.7			1.0	0.4	120	24	0	100		
	29.9	29.9		20.0	20.0		Acetone	0.2	0.0	100	24	0	100		
	29.9	29.9		20.0	20.0			0.1	0.1	100	24	0	100		
	29.9	29.9		20.0	20.0			0.2	0.0	120	24	0	100		
IN40-E-GM	27.8	27.8		18.5	18.5			2.0	5.5	120	24	0	100		
	27.4	27.4		18.2	18.2			3.0	5.8	120	24	0	100		
	29.6	29.6		19.7	19.7		Methyl formate	1.5	0.0	100	24	0	100		
	29.7	29.7		19.8	19.8			0.8	0.1	100	24	0	100		
	29.1	29.1		19.4	19.4			3.0	0.0	120	24	0	100		
IN40-E-BA	29.6	29.6		19.8	19.8			1.0	0.2	120	24	0	100		
	29.8	29.8		19.8	19.8			0.5	0.3	120	24	0	100		
	27.8	27.8		18.5	18.5			2.0	5.5	120	24	0	100		
	27.4	27.4		18.2	18.2			3.0	5.8	120	24	0	100		
	29.9	29.9		19.9	19.9		Butyraldehyde	0.3	0.0	100	24	0	100		
IN40-E-BA	29.9	29.9		19.9	19.9			0.2	0.1	100	24	0	100		
	29.9	29.9		19.9	19.9			0.5	0.0	120	24	0	100		
	29.9	29.9		19.9	19.9			0.2	0.1	120	24	0	100		
	29.9	29.9		19.9	19.9			0.1	0.2	120	24	0	100		
	29.9	29.9		19.9	19.9					120	24		100		

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig 23

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol							Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
			Ethanol	NPA	IPA	NBA	IBA											
INI15-E	80.0	5.0			10	5			None			0.0	90	24	6	100	100	
	79.9	5.0			10	5			None			0.1	90	24	0	100	100	
	80.0	5.0			10.0	5.0			None			0.0	120	24	100	100	100	
	79.5	5.0			9.9	5.0			None			0.6	120	24	0	100	0	
	79.4	5.0			9.9	5.0			None			0.8	120	24	0	0	0	
INI15-E-Me	79.6	5.0			10.0	5.0			Methanol	0.5		0.0	100	24	0	100	100	
	79.6	5.0			10.0	5.0				0.3		0.2	100	24	0	100	100	
	78.8	4.9			9.9	4.9				1.5		0.0	120	24	0	100	100	
	79.2	5.0			9.9	5.0				0.8		0.2	120	24	0	100	100	
	79.4	5.0			9.9	5.0				0.5		0.3	120	24	0	100	100	
INI15-E-P G	79.1	4.9			9.9	4.9				0.5		0.6	120	24	0	100	100	
	78.6	4.9			9.8	4.9				1.0		0.8	120	24	0	100	0	
	78.4	4.9			9.8	4.9			Propylene glycol	2.0		0.0	100	24	0	100	100	
	79.0	4.9			9.9	4.9				1.0		0.2	100	24	0	100	100	
	76.8	4.8			9.6	4.8				4.0		0.0	120	24	0	100	100	
INI15-E-MBK	78.2	4.9			9.8	4.9				2.0		0.2	120	24	0	100	100	
	78.9	4.9			9.9	4.9				1.0		0.4	120	24	0	100	100	
	79.8	5.0			10.0	5.0			Methyl isobutyl ketone	0.3		0.0	100	24	0	100	100	
	79.8	5.0			10.0	5.0				0.2		0.1	100	24	0	100	100	
	79.6	5.0			10.0	5.0				0.5		0.0	120	24	0	100	100	
INI15-E-O E	79.1	4.9			9.9	4.9				0.5		0.6	120	24	0	100	100	
	78.6	4.9			9.8	4.9				1.0		0.8	120	24	0	100	0	
	79.2	5.0			9.9	5.0			Ethyl formate	1.0		0.0	100	24	0	100	100	
	79.4	5.0			9.9	5.0				0.6		0.1	100	24	0	100	100	
	76.0	4.8			9.5	4.8				5.0		0.0	120	24	0	100	100	
INI15-E-P A	78.2	4.9			9.8	4.9				2.0		0.2	120	24	0	100	100	
	78.9	4.9			9.9	4.9				1.0		0.4	120	24	0	100	100	
	76.3	4.8			9.5	4.8				4.0		0.6	120	24	0	100	100	
	75.4	4.7			9.4	4.7				5.0		0.8	120	24	0	100	0	
	79.8	5.0			10.0	5.0			Propion aldehyde	0.2		0.0	100	24	0	100	100	
INI15-E-P A	79.8	5.0			10.0	5.0				0.1		0.1	100	24	0	100	100	
	79.7	5.0			10.0	5.0				0.4		0.0	120	24	0	100	100	
	79.8	5.0			10.0	5.0				0.2		0.1	120	24	0	100	100	
	79.8	5.0			10.0	5.0				0.1		0.2	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 24

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	HC Naphtha	Ether DBE	Alcohol					Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)		Room Temp 25° C	Low Temp -10° C		
			Ethanol	NPA	IPA	NBA	IBA										
IN75-E	20.0	5.0			35	40		None		0.0	90	24	100	100			
	20.0	5.0			35.0	39.9		None		0.1	90	24	100	100			
	20.0	5.0			34.9	39.9		None		0.2	90	24	0	100			
	20.0	5.0			35.0	40.0		None		0.0	120	24	100	100			
	19.9	5.0			34.8	39.8		None		0.6	120	24	100	100			
	19.8	5.0			34.7	39.7		None		0.8	120	24	0	100			
IN75-E-Me	19.8	5.0			34.7	39.6		Methanol	1.0	0.0	100	24	0	100			
	19.8	5.0			34.7	39.7			0.5	0.3	100	24	0	100			
	19.6	4.9			34.3	39.2			2.0	0.0	120	24	0	100			
	19.7	4.9			34.5	39.5			1.0	0.3	120	24	0	100			
	19.8	5.0			34.7	39.6			0.5	0.5	120	24	0	100			
IN75-E-E G	19.2	4.8			33.6	38.4		Ethylene glycol	4.0	0.0	100	24	0	100			
	19.5	4.9			34.2	39.0			2.0	0.4	100	24	0	100			
	18.8	4.7			32.9	37.6			6.0	0.0	120	24	0	100			
	19.3	4.8			33.8	38.7			3.0	0.3	120	24	0	100			
	19.6	4.9			34.3	39.2			1.5	0.5	120	24	0	100			
IN75-E-MPK	20.0	5.0			34.9	39.9		Methyl-n-propyl ketone	0.2	0.0	100	24	0	100			
	20.0	5.0			34.9	39.9			0.1	0.1	100	24	0	100			
	20.0	5.0			34.9	39.9			0.2	0.0	120	24	0	100			
	20.0	5.0			34.9	39.9			0.1	0.1	120	24	0	100			
	19.6	4.9			34.3	39.2		Ethyl formate	2.0	0.0	100	24	0	100			
IN75-E-GE	19.8	4.9			34.6	39.6			1.0	0.1	100	24	0	100			
	19.3	4.8			33.8	38.6			3.5	0.0	120	24	0	100			
	19.7	4.9			34.4	39.3			1.5	0.2	120	24	0	100			
	19.8	4.9			34.6	39.6			0.8	0.3	120	24	0	100			
	19.9	5.0			34.9	39.9		Acetaldehyde	0.3	0.0	100	24	0	100			
IN75-E-AA	19.9	5.0			34.9	39.9			0.2	0.1	100	24	0	100			
	19.9	5.0			34.8	39.8			0.6	0.0	120	24	0	100			
	19.9	5.0			34.9	39.8			0.3	0.1	120	24	0	100			
	19.9	5.0			34.9	39.8			0.2	0.2	120	24	0	100			

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 25

Designation of Formulation	Fuel Composition (wt%)										Additive		Water		Aluminum Corrosion Test		Stability of Fuel*	
	HC		Ether		Alcohol				None		Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp 25° C	Low Temp -10° C
	Naphtha	30.0	MTBE	Ethanol	NPA	IPA	NBA	IBA	None	None								
EIB40-E	30.0	30.0	29.9	20.0				20.0	None				0.0	90	24	100	100	100
	30.0	30.0	29.9	20.0				20.0	None				0.1	90	24	0	100	100
	30.0	30.0	30.0	20.0				20.0	None				0.0	120	24	100	100	100
	27.9	27.9	27.9	18.6				18.6	None				6.9	120	24	0	100	0
	27.8	27.8	27.8	18.6				18.6	None				7.2	120	24	0	0	0
EIB40-E-Me	29.6	29.6	29.6	19.7				19.7	Methanol			1.5	0.0	100	24	0	100	100
	29.6	29.6	29.6	19.7				19.7				0.8	0.5	100	24	0	100	100
	29.4	29.4	29.4	19.6				19.6				2.0	0.0	120	24	0	100	100
	29.6	29.6	29.6	19.7				19.7				1.0	0.5	120	24	0	100	100
	29.6	29.6	29.6	19.7				19.7				0.5	1.0	120	24	0	100	100
EIB40-E-E-G	29.7	29.7	29.7	19.8				19.8	Ethylene glycol			1.0	0.0	100	24	0	100	100
	29.7	29.7	29.7	19.8				19.8				0.7	0.4	100	24	0	100	100
	29.4	29.4	29.4	19.6				19.6				2.0	0.0	120	24	0	100	100
	29.5	29.5	29.5	19.6				19.6				1.5	0.3	120	24	0	100	100
	29.6	29.6	29.6	19.7				19.7				1.0	0.5	120	24	0	100	100
EIB40-E-Ac	29.9	29.9	29.9	20.0				20.0	Acetone			0.2	0.0	100	24	0	100	100
	29.9	29.9	29.9	20.0				20.0				0.1	0.1	100	24	0	100	100
	29.1	29.1	29.1	19.4				19.4				3.0	0.0	120	24	0	100	100
	29.6	29.6	29.6	19.8				19.8				1.0	0.2	120	24	0	100	100
	29.8	29.8	29.8	19.9				19.9				0.2	0.5	120	24	0	100	100
EIB40-E-GM	27.0	27.0	27.0	18.0				18.0				3.0	6.9	120	24	0	100	100
	26.6	26.6	26.6	17.8				17.8				4.0	7.2	120	24	0	100	0
	29.3	29.3	29.3	19.5				19.5	Methyl formate			2.5	0.0	100	24	0	100	100
	29.5	29.5	29.5	19.7				19.7				1.5	0.2	100	24	0	100	100
	28.5	28.5	28.5	19.0				19.0				5.0	0.0	120	24	0	100	100
EIB40-E-BA	29.3	29.3	29.3	19.6				19.6				2.0	0.2	120	24	0	100	100
	29.6	29.6	29.6	19.7				19.7				1.0	0.5	120	24	0	100	100
	27.3	27.3	27.3	18.2				18.2				2.0	6.9	120	24	0	100	100
	26.9	26.9	26.9	18.0				18.0				3.0	7.2	120	24	0	100	0
	29.8	29.8	29.8	19.9				19.9	Butyraldehyde			0.6	0.0	100	24	0	100	100
	29.8	29.8	29.8	19.9				19.9				0.1	0.5	100	24	0	100	100
	29.7	29.7	29.7	19.8				19.8				1.0	0.0	120	24	0	100	100
	29.8	29.8	29.8	19.9				19.9				0.2	0.5	120	24	0	100	100
	29.7	29.7	29.7	19.8				19.8				0.1	1.0	120	24	0	100	100
	27.6	27.6	27.6	18.4				18.4				1.0	6.9	120	24	0	100	100
	27.2	27.2	27.2	18.2				18.2				2.0	7.2	120	24	0	100	0

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 26

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*			
	HC Naphtha	Ether ETBE	Alcohol				Ethanol	NPA	IPA	NBA	IBA	Kind		Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
EIB15-E	80.0	5.0	5.0					5.0			10.0	None	0.0	90	24	32	100	100	
	79.9	5.0	5.0					5.0			10.0	None	0.1	90	24	0	100	100	
	80.0	5.0	5.0					5.0			10.0	None	0.0	120	24	100	100	100	
	79.5	5.0	5.0					5.0			9.9	None	0.6	120	24	0	100	0	
	79.4	5.0	5.0					5.0			9.9	None	0.8	120	24	0	0	0	
EIB15-E-Me	79.2	5.0	5.0					5.0			9.9	Methanol	0.0	100	24	0	100	100	
	79.4	5.0	5.0					5.0			9.9		0.3	100	24	0	100	100	
	78.8	4.9	4.9					4.9			9.9		0.0	120	24	0	100	100	
	79.0	4.9	4.9					4.9			9.9		0.4	120	24	0	100	100	
	79.0	4.9	4.9					4.9			9.9		0.6	120	24	0	100	100	
EIB15-E-PG	78.2	4.9	4.9					4.9			9.8		0.8	120	24	0	100	0	
	79.0	4.9	4.9					4.9			9.9		1.5	100	24	0	100	100	
	79.2	5.0	5.0					5.0			9.9	Propylene glycol	0.0	100	24	0	100	100	
	77.6	4.9	4.9					4.9			9.7		0.0	120	24	0	100	100	
	78.2	4.9	4.9					4.9			9.8		0.3	120	24	0	100	100	
EIB15-E-DEK	78.8	4.9	4.9					4.9			9.9		0.5	120	24	0	100	100	
	79.2	5.0	5.0					5.0			9.9	Diethyl ketone	1.0	100	24	0	100	100	
	79.6	5.0	5.0					5.0			10.0		0.1	100	24	0	100	100	
	78.8	4.9	4.9					4.9			9.9		0.0	120	24	0	100	100	
	79.4	5.0	5.0					5.0			9.9		0.1	120	24	0	100	100	
EIB15-E-GM	79.6	5.0	5.0					5.0			10.0		0.3	120	24	0	100	100	
	77.5	4.8	4.8					4.8			9.7		0.6	120	24	0	100	100	
	76.6	4.8	4.8					4.8			9.6		0.8	120	24	0	100	0	
	78.8	4.9	4.9					4.9			9.9	Methyl acetate	1.5	100	24	0	100	100	
	79.0	4.9	4.9					4.9			9.9		0.2	100	24	0	100	100	
EIB15-E-PA	77.6	4.9	4.9					4.9			9.7		0.0	120	24	0	100	100	
	79.0	4.9	4.9					4.9			9.9		0.2	120	24	0	100	100	
	79.2	5.0	5.0					5.0			9.9		0.5	120	24	0	100	100	
	78.2	4.9	4.9					4.9			9.8		0.6	120	24	0	100	100	
	77.3	4.8	4.8					4.8			9.7		0.8	120	24	0	100	0	
EIB15-E-PA	79.5	5.0	5.0					5.0			9.9	Propional aldehyde	0.6	100	24	0	100	100	
	79.7	5.0	5.0					5.0			10.0		0.3	100	24	0	100	100	
	79.2	5.0	5.0					5.0			9.9		0.0	120	24	0	100	100	
	79.5	5.0	5.0					5.0			9.9		0.2	120	24	0	100	100	
	79.5	5.0	5.0					5.0			9.9		0.4	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 27

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether DBE	Alcohol								Kind	Loading/Fuel (wt%)		Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
			Ethanol	NPA	IPA	NBA	IBA											
EIB75	20.0	5.0	35.0						40.0	None		0.0	90	24	100	100	100	
	20.0	5.0	35.0						39.9	None		0.1	90	24	100	100	100	
	20.0	5.0	34.9						39.9	None		0.2	90	24	0	100	100	
	20.0	5.0	35.0						40.0	None		0.0	120	24	100	100	100	
	19.8	5.0	34.7						39.6	None		1.0	120	24	100	100	100	
	19.8	4.9	34.6						39.5	None		1.2	120	24	0	100	100	
EIB75-Me	19.7	4.9	34.5						39.4	Methanol	1.5	0.0	100	24	0	100	100	
	19.7	4.9	34.5						39.4		1.0	0.5	100	24	0	100	100	
	19.6	4.9	34.3						39.2		2.0	0.0	120	24	0	100	100	
	19.6	4.9	34.3						39.2		1.5	0.5	120	24	0	100	100	
	19.6	4.9	34.3						39.2		1.0	1.0	120	24	0	100	100	
EIB75-E-G	19.6	4.9	34.3						39.2	Ethylene glycol	2.0	0.0	100	24	0	100	100	
	19.7	4.9	34.5						39.4		1.0	0.5	100	24	0	100	100	
	20.0	5.0	35.0						40.0									
	19.2	4.8	33.6						38.4		4.0	0.0	120	24	0	100	100	
	19.3	4.8	33.8						38.6		3.0	0.5	120	24	0	100	100	
	19.4	4.9	34.0						38.8		2.0	1.0	120	24	0	100	100	
EIB75-MEK	19.4	4.9	34.0						38.8	Methyl ethyl ketone	3.0	0.0	100	24	0	100	100	
	19.9	5.0	34.8						39.8		0.3	0.3	100	24	0	100	100	
	19.0	4.8	33.3						38.0		5.0	0.0	120	24	0	100	100	
	19.6	4.9	34.2						39.1		2.0	0.2	120	24	0	100	100	
	19.8	4.9	34.6						39.5		0.2	1.0	120	24	0	100	100	
EIB75-E-GM	19.2	4.8	33.6						38.4	Methyl formate	4.0	0.0	100	24	0	100	100	
	19.5	4.9	34.2						39.1		2.0	0.3	100	24	0	100	100	
	18.4	4.6	32.2						36.8		8.0	0.0	120	24	0	100	100	
	19.1	4.8	33.5						38.3		4.0	0.3	120	24	0	100	100	
	19.4	4.9	34.0						38.8		2.0	1.0	120	24	0	100	100	
EIB75-AA	19.8	5.0	34.7						39.7	Acetaldehyde	0.8	0.0	100	24	0	100	100	
	19.9	5.0	34.8						39.8		0.2	0.3	100	24	0	100	100	
	19.8	5.0	34.7						39.6		1.0	0.0	120	24	0	100	100	
	19.9	5.0	34.8						39.7		0.4	0.3	120	24	0	100	100	
	19.9	5.0	34.8						39.7		0.2	0.5	120	24	0	100	100	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 28

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol						Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)		Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
			Ethanol	NPA	IPA	NBA	IBA										
PNB30-E	40.0	30.0			10.0	10.0	10.0	None			0.0	80	120	15	100	100	
	39.9	30.0			10.0	10.0	10.0	None			0.1	80	120	0	100	100	
	40.0	30.0			10.0	10.0	10.0	None			0.0	120	24	100	100	100	
	38.9	29.2			9.7	9.7	9.7	None			2.7	120	24	0	100	0	
PNB30-E-Me	38.8	29.1			9.7	9.7	9.7	None			3.0	120	24	0	0	0	
	39.6	29.7			9.9	9.9	9.9	Methanol	1.0		0.0	100	24	0	100	100	
	39.7	29.8			9.9	9.9	9.9		0.4		0.3	100	24	0	100	100	
	39.4	29.6			9.9	9.9	9.9		1.5		0.0	120	24	0	100	100	
PNB30-E-G	39.5	29.6			9.9	9.9	9.9		1.0		0.2	120	24	0	100	100	
	39.7	29.8			9.9	9.9	9.9		0.5		0.3	120	24	0	100	100	
	38.5	28.9			9.6	9.6	9.6		1.0		2.7	120	24	0	100	100	
	38.0	28.5			9.5	9.5	9.5		2.0		3.0	120	24	0	100	0	
PNB30-E-Ac	39.2	29.4			9.8	9.8	9.8	Ethylene glycol	2.0		0.0	100	24	0	100	100	
	39.5	29.6			9.9	9.9	9.9		1.0		0.2	100	24	0	100	100	
	39.0	29.3			9.8	9.8	9.8		2.5		0.0	120	24	0	100	100	
	39.3	29.5			9.8	9.8	9.8		1.5		0.2	120	24	0	100	100	
PNB30-E-GM	39.5	29.6			9.9	9.9	9.9		1.0		0.3	120	24	0	100	100	
	39.9	29.9			10.0	10.0	10.0	Acetone	0.2		0.0	100	24	0	100	100	
	39.9	29.9			10.0	10.0	10.0		0.2		0.0	120	24	0	100	100	
	38.1	28.6			9.5	9.5	9.5		2.0		2.7	120	24	0	100	0	
PNB30-E-BA	37.6	28.2			9.4	9.4	9.4		3.0		3.0	120	24	0	100	0	
	39.4	29.6			9.9	9.9	9.9	Methyl formate	1.5		0.0	100	24	0	100	100	
	39.5	29.6			9.9	9.9	9.9		1.0		0.2	100	24	0	100	100	
	39.0	29.3			9.8	9.8	9.8		2.5		0.0	120	24	0	100	100	
PNB30-E-BA	39.3	29.5			9.8	9.8	9.8		1.5		0.2	120	24	0	100	100	
	39.6	29.7			9.9	9.9	9.9		0.6		0.3	120	24	0	100	100	
	37.7	28.3			9.4	9.4	9.4		3.0		2.7	120	24	0	100	100	
	37.0	27.8			9.3	9.3	9.3		4.5		3.0	120	24	0	100	0	
PNB30-E-BA	39.8	29.9			10.0	10.0	10.0	Butyraldehyde	0.4		0.0	100	24	0	100	100	
	39.9	29.9			10.0	10.0	10.0		0.1		0.2	100	24	0	100	100	
	39.8	29.9			10.0	10.0	10.0		0.5		0.0	120	24	0	100	100	
	39.8	29.9			10.0	10.0	10.0		0.2		0.3	120	24	0	100	100	

*1 100 — Perfectly phase-solved, 0 — Layer-separated

Fig. 29

Designation of Formulation	Fuel Composition (wt%)								Additive		Water		Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether DBE	Alcohol						Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C		
			Ethanol	NPA	IPA	NBA	IBA										
PNB15-E	80.0	5.0		5.0	5.0	5.0	5.0	None		80	120	3	100	100			
	79.9	5.0		5.0	5.0	5.0	5.0	None		80	120	0	100	100			
	80.0	5.0		5.0	5.0	5.0	5.0	None		120	24	100	100	100			
	79.6	5.0		5.0	5.0	5.0	5.0	None		120	24	0	100	0			
	79.4	5.0		5.0	5.0	5.0	5.0			120	24	0	0	0			
PNB15-E-Me	79.4	5.0		5.0	5.0	5.0	5.0	Methanol	0.8	100	24	0	100	100			
	79.5	5.0		5.0	5.0	5.0	5.0		0.4	100	24	0	100	100			
	78.8	4.9		4.9	4.9	4.9	4.9		1.5	120	24	0	100	100			
	79.0	4.9		4.9	4.9	4.9	4.9		1.0	120	24	0	100	100			
	79.4	5.0		5.0	5.0	5.0	5.0		0.5	120	24	0	100	100			
	78.0	4.9		4.9	4.9	4.9	4.9		2.0	120	24	0	100	100			
	77.0	4.8		4.8	4.8	4.8	4.8		3.0	120	24	0	100	0			
PNB15-E-PG	77.6	4.9		4.9	4.9	4.9	4.9	Propylene glycol	3.0	100	24	0	100	100			
	78.6	4.9		4.9	4.9	4.9	4.9		1.5	100	24	0	100	100			
	76.8	4.8		4.8	4.8	4.8	4.8		4.0	120	24	0	100	100			
	78.2	4.9		4.9	4.9	4.9	4.9		2.0	120	24	0	100	100			
	79.0	4.9		4.9	4.9	4.9	4.9		1.0	120	24	0	100	100			
PNB15-E-MPK	79.8	5.0		5.0	5.0	5.0	5.0	Methyl-n-propyl ketone	0.3	100	24	0	100	100			
	79.8	5.0		5.0	5.0	5.0	5.0		0.2	100	24	0	100	100			
	79.6	5.0		5.0	5.0	5.0	5.0		0.5	120	24	0	100	100			
	79.7	5.0		5.0	5.0	5.0	5.0		0.2	120	24	0	100	100			
	76.4	4.8		4.8	4.8	4.8	4.8		4.0	120	24	0	100	100			
	75.4	4.7		4.7	4.7	4.7	4.7		5.0	120	24	0	100	0			
PNB15-E-SM	78.8	4.9		4.9	4.9	4.9	4.9	Methyl acetate	1.5	100	24	0	100	100			
	79.0	4.9		4.9	4.9	4.9	4.9		1.0	100	24	0	100	100			
	75.2	4.7		4.7	4.7	4.7	4.7		6.0	120	24	0	100	100			
	77.4	4.8		4.8	4.8	4.8	4.8		3.0	120	24	0	100	100			
	79.0	4.9		4.9	4.9	4.9	4.9		1.0	120	24	0	100	100			
	74.8	4.7		4.7	4.7	4.7	4.7		6.0	120	24	0	100	100			
	73.8	4.6		4.6	4.6	4.6	4.6		7.0	120	24	0	100	0			
PNB15-E-AA	79.8	5.0		5.0	5.0	5.0	5.0	Acetaldehyde	0.3	100	24	0	100	100			
	79.8	5.0		5.0	5.0	5.0	5.0		0.2	100	24	0	100	100			
	79.6	5.0		5.0	5.0	5.0	5.0		0.5	120	24	0	100	100			
	79.7	5.0		5.0	5.0	5.0	5.0		0.2	120	24	0	100	100			

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 30

Designation of Formulation	Fuel Composition (wt%)										Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether ETBE	Alcohol						Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Time (hr)		Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C		
			Ethanol	IPA														
				NPA	IPA	NBA	IBA											
PNB75-E	20.0	5.0		25.0	25.0	25.0	25.0	None			0.0	80	120	100	100	100		
	20.0	5.0		24.9	25.0	25.0	25.0	None			0.1	80	120	92	100	100		
	20.0	5.0		24.9	24.9	25.0	25.0	None			0.2	80	120	0	100	100		
	20.0	5.0		25.0	25.0	25.0	25.0	None			0.0	120	24	100	100	100		
	17.7	4.4		22.1	22.1	22.1	22.1	None			11.7	120	24	0	100	0		
PNB75-E-Me	17.6	4.4		22.0	22.0	22.0	22.0	None			12.1	120	24	0	0	0		
	19.8	5.0		24.8	24.8	24.8	24.8	Methanol	1.0		0.0	100	24	0	100	100		
	19.9	5.0		24.8	24.8	24.8	24.8		0.4		0.3	100	24	0	100	100		
	19.6	4.9		24.5	24.5	24.5	24.5		2.0		0.0	120	24	0	100	100		
	19.7	4.9		24.6	24.6	24.6	24.6		1.5		0.2	120	24	0	100	100		
PNB75-E-G	19.8	4.9		24.7	24.7	24.7	24.7		0.8		0.4	120	24	0	100	100		
	17.3	4.3		21.6	21.6	21.6	21.6		2.0		11.7	120	24	0	100	100		
	17.0	4.2		21.2	21.2	21.2	21.2		3.0		12.1	120	24	0	100	0		
	19.2	4.8		24.0	24.0	24.0	24.0	Ethylene glycol	4.0		0.0	100	24	0	100	100		
	19.6	4.9		24.6	24.6	24.6	24.6		1.5		0.3	100	24	0	100	100		
PNB75-E-MEK	19.0	4.8		23.8	23.8	23.8	23.8		5.0		0.0	120	24	0	100	100		
	19.3	4.8		24.2	24.2	24.2	24.2		3.0		0.3	120	24	0	100	100		
	19.6	4.9		24.5	24.5	24.5	24.5		1.5		0.5	120	24	0	100	100		
	19.9	5.0		24.9	24.9	24.9	24.9	Methyl ethyl ketone	0.3		0.0	100	24	0	100	100		
	19.9	5.0		24.9	24.9	24.9	24.9		0.1		0.2	100	24	0	100	100		
PNB75-E-GE	19.9	5.0		24.9	24.9	24.9	24.9		0.5		0.0	120	24	0	100	100		
	17.1	4.3		21.3	21.3	21.3	21.3		3.0		11.7	120	24	0	100	100		
	16.8	4.2		21.0	21.0	21.0	21.0		4.0		12.1	120	24	0	100	0		
	19.2	4.8		24.0	24.0	24.0	24.0	Ethyl formate	4.0		0.0	100	24	0	100	100		
	19.6	4.9		24.5	24.5	24.5	24.5		2.0		0.2	100	24	0	100	100		
PNB75-E-PA	18.8	4.7		23.5	23.5	23.5	23.5		6.0		0.0	120	24	0	100	100		
	19.4	4.8		24.2	24.2	24.2	24.2		3.0		0.2	120	24	0	100	100		
	19.7	4.9		24.7	24.7	24.7	24.7		1.0		0.4	120	24	0	100	100		
	16.9	4.2		21.1	21.1	21.1	21.1		4.0		11.7	120	24	0	100	100		
	16.6	4.1		20.7	20.7	20.7	20.7		5.0		12.1	120	24	0	100	0		
PNB75-E-PA	19.9	5.0		24.9	24.9	24.9	24.9	Propion aldehyde	0.3		0.0	100	24	0	100	100		
	19.9	5.0		24.9	24.9	24.9	24.9		0.1		0.2	100	24	0	100	100		
	19.9	5.0		24.9	24.9	24.9	24.9		0.5		0.0	120	24	0	100	100		
	19.9	5.0		24.9	24.9	24.9	24.9		0.2		0.2	120	24	0	100	100		

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 31

Designation of Formulation	Fuel Composition (wt%)						Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol			Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
			Ethanol	NPA	IPA									NBA
EIPP30-E	40.0	30.0	10.0		10.0		None		0.0	80	120	64	100	100
	39.9	30.0	10.0		10.0		None		0.1	80	120	0	100	100
	40.0	30.0	10.0		10.0		None		0.0	120	24	100	100	100
	38.4	28.8	9.6		9.6		None		3.9	120	24	0	100	0
	38.3	28.7	9.6		9.6		None		4.2	120	24	0	0	0
EIPP30-E-Me	39.4	29.6	9.9		9.9		Methanol	1.5	0.0	100	24	0	100	100
	39.6	29.7	9.9		9.9			0.5	0.4	100	24	0	100	100
	39.0	29.3	9.8		9.8			2.5	0.0	120	24	0	100	100
	39.2	29.4	9.8		9.8			1.5	0.5	120	24	0	100	100
	39.4	29.6	9.9		9.9			0.5	1.0	120	24	0	100	100
EIPP30-E-EG	39.2	29.4	9.8		9.8		Ethylene glycol	2.0	0.0	100	24	0	100	100
	39.4	29.6	9.9		9.9			1.0	0.4	100	24	0	100	100
	38.0	28.5	9.5		9.5			5.0	0.0	120	24	0	100	100
	38.6	28.9	9.6		9.6			3.0	0.6	120	24	0	100	100
	38.8	29.1	9.7		9.7			2.0	1.0	120	24	0	100	100
EIPP30-E-Ac	38.8	29.1	9.7		9.7		Acetone	3.0	0.0	100	24	0	100	100
	39.8	29.9	10.0		10.0			0.2	0.3	100	24	0	100	100
	38.4	28.8	9.6		9.6			4.0	0.0	120	24	0	100	100
	39.5	29.6	9.9		9.9			1.0	0.2	120	24	0	100	100
								0.2	0.5	120	24	0	100	100
	36.0	27.0	9.0		9.0			6.0	3.9	120	24	0	100	100
	35.5	26.6	8.9		8.9			7.0	4.2	120	24	0	100	0
EIPP30-E-GM	39.4	29.6	9.9		9.9		Methyl formate	1.5	0.0	100	24	0	100	100
	39.5	29.6	9.9		9.9			1.0	0.2	100	24	0	100	100
	37.6	28.2	9.4		9.4			6.0	0.0	120	24	0	100	100
	39.4	29.6	9.9		9.9			1.0	0.5	120	24	0	100	100
	39.5	29.6	9.9		9.9			0.2	1.0	120	24	0	100	100
	35.6	26.7	8.9		8.9			7.0	3.9	120	24	0	100	100
	35.1	26.3	8.8		8.8			8.0	4.2	120	24	0	100	0
EIPP30-E-BA	39.8	29.8	9.9		9.9		Butyraldehyde	0.6	0.0	100	24	0	100	100
	39.8	29.9	10.0		10.0			0.2	0.3	100	24	0	100	100
	39.6	29.7	9.9		9.9			1.0	0.0	120	24	0	100	100
	39.7	29.8	9.9		9.9			0.2	0.5	120	24	0	100	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 32

Designation of Formulation	Fuel Composition (wt%)						Additive		Water		Aluminum Corrosion Test		
	HC Naphtha	Ether DBE	Alcohol			Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Stability of Fuel*1
			Ethanol	NPA	I.P.A. N.B.A.								
EIPP15-E	80.0	5.0	5.0		5.0				0.0	80	120	9	100
	79.9	5.0	5.0		5.0				0.1	80	120	0	100
	80.0	5.0	5.0		5.0				0.0	120	24	100	100
	79.4	5.0	5.0		5.0				0.8	120	24	0	100
	79.2	5.0	5.0		5.0				1.0	120	24	0	0
EIPP15-E-Me	79.2	5.0	5.0		5.0	Methanol	1.0		0.0	100	24	0	100
	79.3	5.0	5.0		5.0		0.5		0.4	100	24	0	100
	78.4	4.9	4.9		4.9		2.0		0.0	120	24	0	100
	78.9	4.9	4.9		4.9		1.0		0.4	120	24	0	100
	79.1	4.9	4.9		4.9		0.5		0.6	120	24	0	100
EIPP15-E-PG	78.0	4.9	4.9		4.9	Propylene glycol	2.5		0.0	100	24	0	100
	78.6	4.9	4.9		4.9		1.5		0.3	100	24	0	100
	76.8	4.8	4.8		4.8		4.0		0.0	120	24	0	100
	78.1	4.9	4.9		4.9		2.0		0.4	120	24	0	100
	78.4	4.9	4.9		4.9		1.5		0.5	120	24	0	100
EIPP15-E-DEK	78.4	4.9	4.9		4.9	Diethyl ketone	2.0		0.0	100	24	0	100
	79.6	5.0	5.0		5.0		0.2		0.3	100	24	0	100
	77.6	4.9	4.9		4.9		3.0		0.0	120	24	0	100
	79.2	5.0	5.0		5.0		0.8		0.2	120	24	0	100
	76.2	4.8	4.8		4.8		0.2		0.5	120	24	0	100
EIPP15-E-SM	75.2	4.7	4.7		4.7		4.0		0.8	120	24	0	100
	79.0	4.9	4.9		4.9		5.0		1.0	120	24	0	100
	79.2	5.0	5.0		5.0	Methyl acetate	1.2		0.0	100	24	0	100
	77.2	4.8	4.8		4.8		0.8		0.2	100	24	0	100
	78.2	4.9	4.9		4.9		3.5		0.0	120	24	0	100
EIPP15-E-PA	78.8	4.9	4.9		4.9		2.0		0.2	120	24	0	100
	75.4	4.7	4.7		4.7		1.0		0.5	120	24	0	100
	74.4	4.7	4.7		4.7		5.0		0.8	120	24	0	100
	79.6	5.0	5.0		5.0	Propion aldehyde	6.0		1.0	120	24	0	100
	79.6	5.0	5.0		5.0		0.5		0.0	100	24	0	100
	79.4	5.0	5.0		5.0		0.2		0.3	100	24	0	100
	79.5	5.0	5.0		5.0		0.8		0.0	120	24	0	100
							0.2		0.4	120	24	0	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 33

Designation of Formulation	Fuel Composition (wt%)										Additive		Water		Aluminum Corrosion Test			Stability of Fuel*	
	HC		Ether		Alcohol						Kind	Loading/Fuel (wt%)	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Evaluation Temp(°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C
	Naphtha	20.0	ETBE	5.0	Ethanol	NPA	IPA	NBA	25.0	25.0									
EIPP75-E	19.6	20.0	4.9	5.0	24.5				24.5	25.0	None			0.0	80	120	100	100	100
	19.7	20.0	4.9	5.0	24.6				24.6	25.0	None			0.1	80	120	100	100	100
		20.0	5.0	5.0	24.9				24.9	25.0	None			0.2	80	120	0	100	100
	19.7	20.0	4.9	5.0	24.6				24.6	25.0	None			0.0	120	24	100	100	100
	19.7	19.7	4.9	4.9	24.6				24.6	24.6	None			1.5	120	24	100	100	100
EIPP75-E-Me	19.6	19.6	4.9	4.9	24.5				24.5	24.5	Methanol	2.0		0.0	100	24	0	100	100
	19.7	19.7	4.9	4.9	24.6				24.6	24.6		1.0		0.5	100	24	0	100	100
	19.4	19.4	4.9	4.9	24.3				24.3	24.3		3.0		0.0	120	24	0	100	100
	19.5	19.5	4.9	4.9	24.4				24.4	24.4		2.0		0.5	120	24	0	100	100
	19.7	19.7	4.9	4.9	24.6				24.6	24.6		0.6		1.0	120	24	0	100	100
EIPP75-E-EG	19.2	19.2	4.8	4.8	24.0				24.0	24.0	Ethylene glycol	4.0		0.0	100	24	0	100	100
	19.5	19.5	4.9	4.9	24.4				24.4	24.4		2.0		0.5	100	24	0	100	100
	18.0	18.0	4.5	4.5	22.5				22.5	22.5		10.0		0.0	120	24	0	100	100
	18.7	18.7	4.7	4.7	23.4				23.4	23.4		6.0		0.5	120	24	0	100	100
	19.2	19.2	4.8	4.8	24.0				24.0	24.0		3.0		1.0	120	24	0	100	100
EIPP75-E-MEK	19.4	19.4	4.9	4.9	24.3				24.3	24.3	Methyl ethyl ketone	3.0		0.0	100	24	0	100	100
	19.9	19.9	5.0	5.0	24.9				24.9	24.9		0.2		0.3	100	24	0	100	100
	19.0	19.0	4.8	4.8	23.8				23.8	23.8		5.0		0.0	120	24	0	100	100
	19.8	19.8	4.9	4.9	24.7				24.7	24.7		1.0		0.2	120	24	0	100	100
	19.4	19.4	4.9	4.9	24.3				24.3	24.3		3.0		0.0	100	24	0	100	100
EIPP75-E-GM	19.4	19.4	4.9	4.9	24.3				24.3	24.3	Methyl formate	3.0		0.0	100	24	0	100	100
	19.5	19.5	4.9	4.9	24.4				24.4	24.4		2.0		0.3	100	24	0	100	100
	18.0	18.0	4.5	4.5	22.5				22.5	22.5		10.0		0.0	120	24	0	100	100
	19.1	19.1	4.8	4.8	23.9				23.9	23.9		4.0		0.5	120	24	0	100	100
	19.4	19.4	4.9	4.9	24.3				24.3	24.3		2.0		1.0	120	24	0	100	100
EIPP75-E-AA	19.9	19.9	5.0	5.0	24.9				24.9	24.9	Acetaldehyde	0.5		0.0	100	24	0	100	100
	19.9	19.9	5.0	5.0	24.9				24.9	24.9		0.2		0.2	100	24	0	100	100
	19.8	19.8	5.0	5.0	24.8				24.8	24.8		1.0		0.0	120	24	0	100	100
	19.9	19.9	5.0	5.0	24.8				24.8	24.8		0.2		0.5	120	24	0	100	100

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 34

Designation of Formulation	Fuel Composition (wt%)					Additive		Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*1	
	HC Naphtha	Alcohol			Kind	Loading/Fuel (wt%)	Evaluation Temp. (°C)		Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	
		Ethanol	N P A	I P A									
E2	98.0	2.0			None		0.0	120	120	1	100	100	
	97.9	2.0			None		0.1	120	120	0	100	100	
	97.8	2.0			None		0.2	120	120	0	100	0	
	97.6	2.0			None		0.4	120	120	0	0	0	
E2-Me	97.5	2.0			Methanol	0.5	0.0	120	120	0	100	100	
E2-EG	97.5	2.0			Ethyl ene glycol	0.5	0.0	120	120	0	100	100	
E2-Ac	96.0	2.0			Acetone	2.0	0.0	120	120	0	100	100	
	96.9	2.0				1.0	0.1	120	120	0	100	100	
	95.8	2.0				2.0	0.2	120	120	0	100	100	
	94.7	1.9				3.0	0.4	120	120	0	100	0	
E2-GE	96.0	2.0			Ethyl formate	2.0	0.0	120	120	0	100	100	
	96.4	2.0				1.5	0.1	120	120	0	100	100	
	93.9	1.9				4.0	0.2	120	120	0	100	100	
	92.7	1.9				5.0	0.4	120	120	0	100	0	
E2-BA	96.5	2.0			Butyl aldehyde	1.5	0.0	120	120	0	100	100	
	96.9	2.0				1.0	0.1	120	120	0	100	100	
	94.9	1.9				3.0	0.2	120	120	0	100	100	
	93.7	1.9				4.0	0.4	120	120	0	100	0	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 35

< Ether Nonloaded Type >

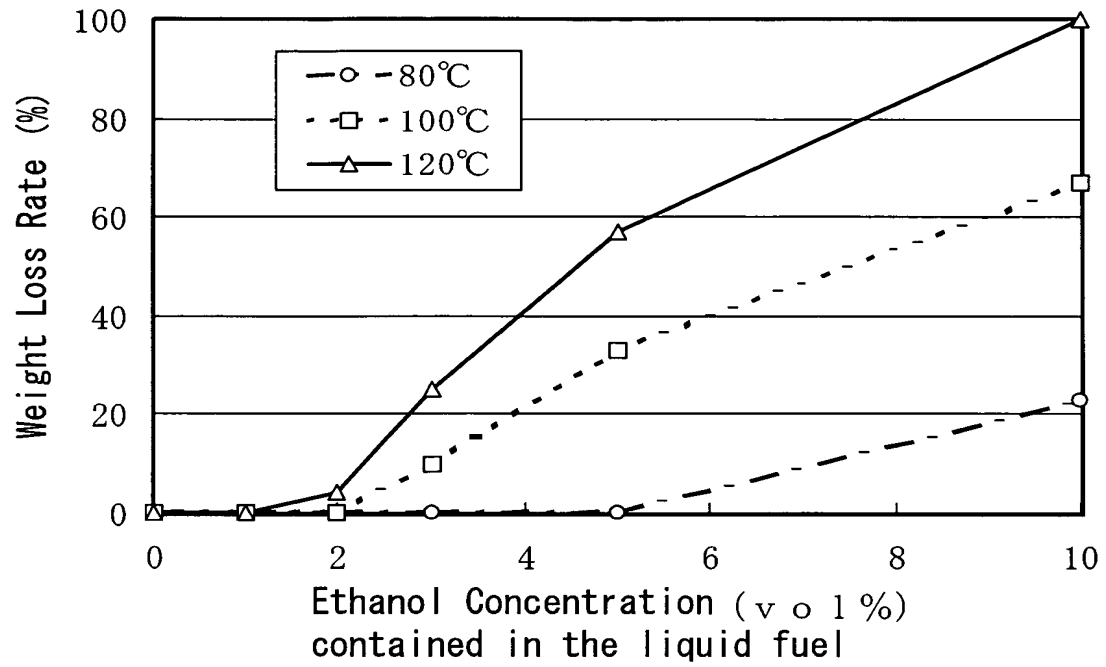
Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water	Methanol			Glycols			Ketones			Esters			Aldehydes		
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E2	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E10	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E20	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E50	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
IN40	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
EIB40	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
EIB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIB75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
PNB30	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB75	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIPP30	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP15	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

< Ether loaded Type >

Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water	Methanol			Glycols			Ketones			Esters			Aldehydes		
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E 1 0 - E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E 2 0 - E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E 5 0 - E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
I N 4 0 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
I N 1 5 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
I N 7 5 - E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
E I B 4 0 - E	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
E I B 1 5 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
E I B 7 5 - E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
P N B 3 0 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
P N B 1 5 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
P N B 7 5 - E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
E I P P 3 0 -	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
E I P P 1 5 -	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
E I P P 7 5 -	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

2003

Fig. 36



Treatment Time 240 Hr

Ethanol Concentration (vol. %)		0	1	2	3	5	10
Weight Loss Rate (%)	80°C	0	0	0	0	0	23
	100°C	0	0	0	10	33	67
	120°C	0	0	4	25	57	100

Fig. 37

Designation of Formulation	Fuel Composition (wt%)						Water Loading/Fuel (wt%)	Aluminum Corrosion Test		
	HC Naphtha	Alcohol				I B A		Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)
		Ethanol	N P A	I P A	N B A					
I PB75	25.0			35.0		40.0	0.00	100	24	100
	25.0			35.0		39.9	0.10	100	24	58
	25.0			34.9		39.9	0.15	100	24	0
	25.0			35.0		40.0	0.00	120	24	100
	25.0			34.9		39.9	0.15	120	24	100
	24.9			34.9		39.9	0.30	120	24	0